MODEL 610B

SWEPT FREQUENCY GENERATOR

INSTRUCTION MANUAL

WITH 6104 & 6108

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WILTRON COMPANY
for better electronics measurements

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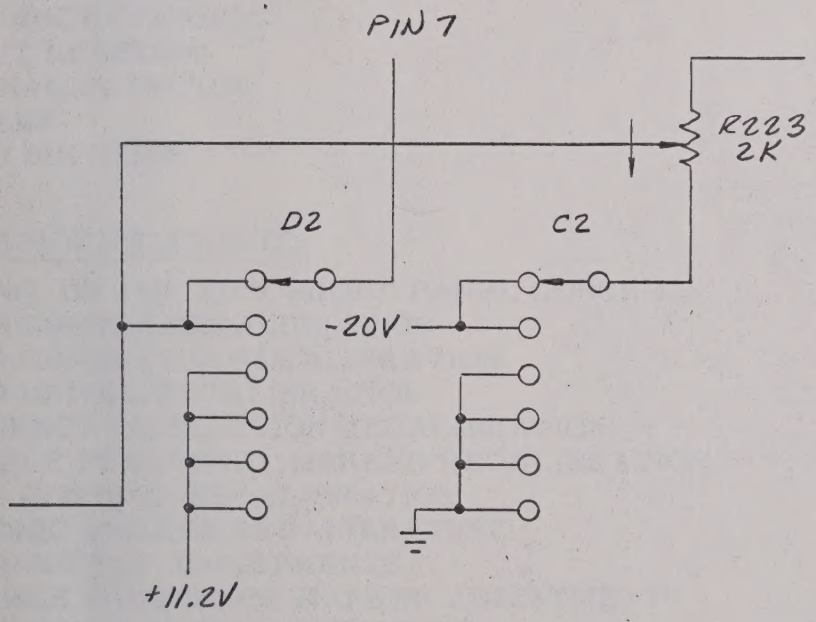
ADDENDUM TO WILTRON MODEL 610B INSTRUCTION MANUAL

1. On the parts list page 50, change the description as follows:

   R246 - delete.

2. On schematic 610B-200, change the following circuit:



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INSTRUCTION MANUALS ON PLUG-INS

FREQUENCY CONTROL, F1

This upper left hand knob sets the start frequency anywhere over the calibrated range of operation of the plug-in.

FREQUENCY CONTROL, F2

An upper right hand knob sets the stop frequency anywhere in the calibrated range of operation of the plug-in. F2 can be set at a higher frequency than F1 for sweeping upward in frequency or at a lower frequency than F1 for sweeping downward in frequency.

VARIABLE MARKER

Between F1 and F2, the marker control sets the frequency of the mark during sweep operation and is the center of the ΔF sweep during the ΔF mode of operation.

FREQUENCY SELECTOR

The major black knob control has six positions whose functions are listed below.

REMOTE. The frequency output is completely determined by the voltage applied on the remote frequency programing at the rear.

F1 TO F2. Frequency sweep between the limits programed by the knobs F1 and F2.

ΔF SWEEP Plus and minus around the variable marker frequency.

CW F1. A fixed frequency non-swept signal selected by the F1 control.

CW MARKER. A fixed frequency non-swept signal selected by the VAR. FREQ. MARKER control.

CW F2. A fixed frequency non-swept signal selected by the F2 control.

The inner red control of the FREQ. SELECTOR switch has two positions for RETRACE RF, ON or OFF. In the 'ON' position the R.F. signal remains on between sweeps. In the RETRACE 'OFF' position the R.F. stays off between sweeps.

ΔF FREQUENCY

The ΔF control sets a calibrated sweep of from 0 to 5% about a center frequency selected by the VAR. FREQ. MARKER control. For example, when set to "2" the frequency sweep would be ±1% of the total frequency spanned by the plug-in frequency range.

SWEEP MODE

This switch selects the manner in which the sweep is initiated. The four positions of the main outer control are listed below.

TRIG. A panel push button initiates a sweep so as to provide single sweep capability.

MANUAL. In this position there is no sweep and the frequency can be manually tuned by the inner red knob.

The inner red control is used to manually tune the frequency when the outer black knob is set at manual. This control will manually tune over the frequency range set by the F1 TO F2 CONTROL or by the ΔF FREQUENCY. During this manual tuning a horizontal output is supplied proportional to the percent of frequency excursion.

LINE SYNC. The switch for syncing at the 60 cycle line frequency. This is often useful in examining hum effects or other effects that are believed to be related to line frequency.

AUTO. The sweeps recur with a minimum delay between sweeps.

Functions of Controls - cont'd

SWEEP TIME (SEC)

The outer black control sets the range of sweep times to one of four ranges covering from 100 seconds per sweep to .01 seconds per sweep. The inner red knob selects the exact sweep desired in the 10:1 range. For example when the black knob is in the 100 - 10 position, the red knob provides a sweep greater than 100 seconds in its most counterclockwise position and a 10 second sweep duration in its most clockwise position.

FROM EXT. DETECTOR

This input provides the means of mixing the marker pips with the signal from an external detector and supplying their combined total to the VERT. OUT jack.

RF IN TO DETECTOR

This input goes into a crystal detector which can be used to detect the R.F. test signal out of the device under test. The output from this detector is on the VERT. OUT jack adjacent.

VERT. OUT

The VERT. OUT jack supplies the output from the built-in detector. This output is normally applied to the vertical axis of an oscilloscope, or XY recorder.

HORIZ. OUT

The HORIZ. OUT provides the sweep voltage output of 0 to + 15 volts sawtooth during F1 TO F2, ΔF, and MANUAL SWEEP MODES. 0 to approximately 15 v d.c. signal depending upon the frequency setting when operating at single frequency on F1 or F2. Output impedance is 10 K ohms.

MODULATION

NORMAL. The NORMAL position levels the R.F. output and permits no internal or external modulation.

INT. AM. The INTERNAL AM position actuates a built-in 1000 Hz amplitude modulation.

EXT AM. The internal leveling stays in operation and amplitude modulation is conducted by the input signal at the EXT. input BNC connector.

1 kHz FREQ. ADJ. Screwdriver control varies internal modulation frequency ±10% around 1 kHz.

EXT. FM. In the EXT. FM position the internal leveling remains on and the frequency is frequency modulated in accordance with the signal applied at the EXT. BNC connector. The input FM signal is internally coupled through approximately 0.1 microfarads capacitance. The input resistance is approximately 50 K ohms. The FM sensitivity is approximately 10 MHz per volt. The frequency response of the internal amplifier is approximately 30 Hz to 200 kHz. For external FM to be operative from this control the FREQ. SELECTOR switch must be in some position other than REMOTE. In the REMOTE position the frequency modulation would need to be conducted in conjunction with the frequency programing at the rear input terminals.

Function of Controls contd.

MODULATION continued

EXT. LEVELING. When the MODULATION control is in the EXT. LEVELING position the EXT. LEVELING sensitivity is adjustable by means of a screwdriver control directly above the EXT. LEVEL position. When the leveling is not being accomplished over the whole frequency band the unleveled light will come on. External leveling can be supplied by the user at the EXT. input BNC next to the LEVELING sensitivity control. A -100mv signal into 10 K ohms is a typical leveling input signal.

FREQUENCY MARKERS

A series of six toggle switches control the frequency markers. Each marker position can be separately turned on and off.

BIRDIE MARKERS AMPLITUDE

This control adjusts the amplitude of all birdie markers internal and external.

EXT. R. F. MARKER INPUT

An R.F. signal introduced on this BNC connector provides a frequency marker at the input frequency.

VAR. FREQ. MARKER AMP.

The inner red control adjusts the amplitude or intensity of the RF marker. The outer black control selects the type of marker, RF PIP (which achieves a notch marker by turning the RF off), VIDEO (which mixes pulse in video and does not disturb RF), and the INTENSITY (which causes an intensity mark on the output display scope.)

REAR TERMINAL CONNECTORS

110/220 VOLT SWITCH. Selects the line voltage to be used, 110 volts or 220 volts.

FUSE. 0.8 Amp. Slo-Blo, replaceable at rear next to power cord.

TRIGGER IN. Sweep can be triggered by +1 volt signal with greater than 1 μs pulse width and greater than 0.1 volt/μsec rise.

BLANKING. Output of +30 v during retrace. Near ground during sweep.

REMOTE FREQ. Terminal A has positive 10 volts output. Terminal D is grounded. Terminal B is the input which controls frequency. Zero volts on terminal B gives the lowest frequency of the plug-in range. Plus 10 volts gives the highest frequency of the plug-in range. Other terminations are made use of for external programing.

VERT. OUT. Optional BNC connectors can provide output from the built-in detector. This rear terminal is in parallel with the front panel connector.

HORIZ. OUT. Optional BNC connectors provide 10 volt sawtooth during sweep. The rear terminal is in parallel with front panel connector.

EXT. INPUT. EXT. INPUT is an optional BNC connector for applying AM or FM or EXT leveling depending on the position of front panel MODULATION switch. In parallel with front panel connector.

Function of Controls contd.

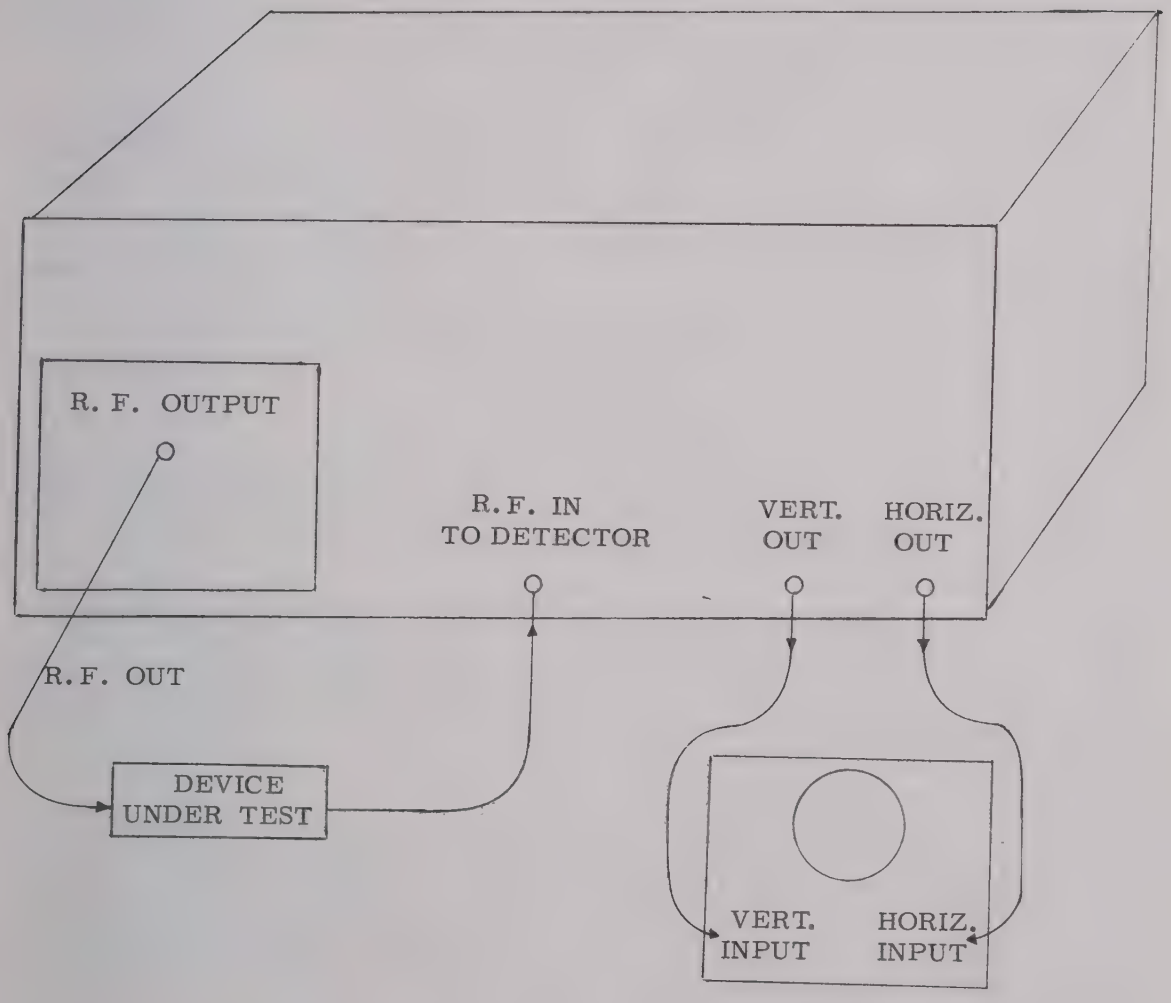
REAR TERMINAL CONNECTORS contd.

VARIABLE MARKER OUT. Optional output BNC provides a pulse out coincident in time with the variable marker.

PEN LIFT CONTACTS. Optional output provides contact closure during retrace to be used in lifting the pen of an XY recorder.

SECTION 3 MEASUREMENT PROCEDURE

Typical Measurement Setup for
Plotting the Amplitude Response vs Frequency
of a device under test



HOW TO PLOT FREQUENCY RESPONSE

The below step-by-step procedure is used for plotting the amplitude response of a device under test as a function of frequency.

1. Plug in power cord to 50-60 Hz, 115 v outlet. (Slider switch on the rear converts the transformer to 230 volt operation.) Turn on the instrument by use of front panel switch. Allow 30 minutes for the instrument to temperature stabilize prior to setting the frequency sweep limits.
2. Set MODULATION switch to NORMAL.
3. Set FREQ. SELECTOR to F1 TO F2.
4. Set F1 to the desired lower test frequency; set F2 to the desired upper test frequency.
5. Set SWEEP MODE switch to AUTO.
6. Set SWEEP TIME switch in the 10-1 range; turn SWEEP TIME VERNIER fully clockwise.
7. Connect output of test device to RF IN, TO DETECTOR connector. Connect VERT. OUT to vertical input of d.c. coupled oscilloscope. Connect HORIZ. OUT to horizontal input of d.c. coupled oscilloscope.
8. Actuate desired frequency markers by switching on their toggle switches.
9. Select desired test signal level by the RF POWER LEVEL controls on the plug-in panel. The maximum output is +13 dbm which equals 1 volt rms output into 50 ohms.
10. Connect RF OUTPUT of sweeper to input port of the device under test. Observe the output response on the oscilloscope.

VARIATIONS IN USE OF SWEEPER

A. When external FM is desired, put the MODULATION switch in the EXT. FM position and apply frequency modulation to the EXT. INPUT.

B. When external AM is desired, put the MODULATION switch in the EXT. AM position and apply the amplitude modulation to the EXT. INPUT.

C. When external leveling is desired, put the MODULATION CONTROL in the EXT. LEVEL position and apply a negative leveling voltage to the EXT. INPUT. Use a screw driver to adjust the EXT. LEVEL CONTROL for the proper leveled output. The UNLEVELED light will come on if the signal is not leveled across the whole frequency band being used.

D. When maximum signal level is desired at the sacrifice of leveling, switch to EXT. LEVEL position and do not apply any EXT. INPUT.

E. When it is desired to sweep around a center frequency, set the FREQ. SELECTOR to ΔF F1, set F1 to the desired center frequency, set ΔF FREQUENCY to the total ΔF frequency to be swept.

F. For use with an XY recorder, set the SWEEP TIME control to 100-10 and the VERNIER to mid range; set the SWEEP MODE switch to TRIG. Push the TRIG button when it is desired to actuate a sweep.

G. For external frequency programing, set the FREQ. SELECTOR to REMOTE and set the output frequency by one of the following two methods:

   1. Connect the voltage output from terminals 3 and 1 to the terminals

ariations in Use of Sweeper - cont'd.

of a potentiometer. Connect the resultant voltage output from the center top of the potentiometer to terminal 2 which sets the frequency. Note: Terminals 1, 2 and 3 are located on the rear chassis marked REMOTE FREQUENCY.

2. Connect a voltage waveform of from +1 to +10 volts between input (terminal 2) and ground (terminal 3). See Section 4 for complete directions.

SECTION 4 REMOTE FREQUENCY CONTROL and PROGRAMMING

The Model 610B has provision, via terminal strip J103 on the rear of the instrument, for two types of frequency control.

Terminal B provides direct coupled frequency control with about 1 Megohm input impedance. This input is uncoupled from terminal C and used when a voltage controlled signal source is desired; e.g., for phase lock, for remote control of frequency, or for injection of an external sweep.

The control relation is 0 to +10 volts relating to 0 to 100% of the frequency range of the plug-in being operated. Thus the Model 6104 100 MHz Plug-In has a control relation of 10 MHz per volt. In remote situations, well shielded leads and minimum ground loops are required to prevent FM.

For resistance control an internal d.c. voltage is provided at terminal A which provides 10.0 volts ±1% when loaded with 10 K ohms. For continuous control a 10 K pot. may be connected as shown in Figure 1(a). For stability and accuracy, a precision wire wound pot. with good linearity should be used.

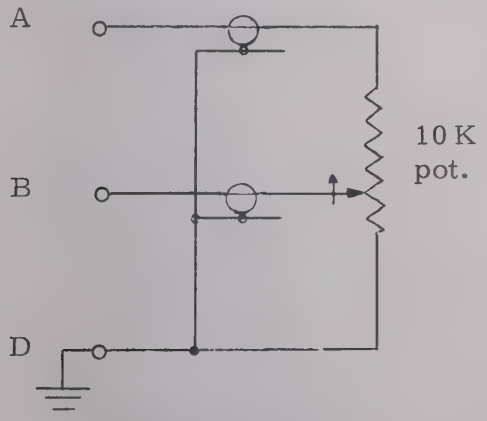
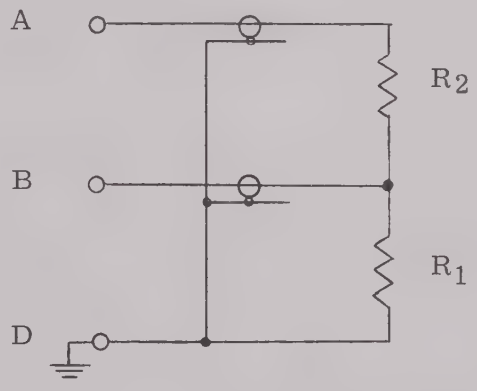


FIGURE 1(a)

By using a standard 10 turn pot. with the dial calibrated in decimal units the frequency will be direct reading for the Model 6104 Plug-In. A specific frequency can be established with fixed resistors as shown in Figure 1(b). For accuracy and stability, precision metal film or wirewound resistors should be used. Similarly, additional tap points along the 10 K total resistance and a selector switch connected to terminal B will provide multiple preset frequencies.



R_1 = F x 10 K ohms

R_2 = 10 K - R_1

where F is the desired frequency expressed in % of plug-in band.

FIGURE 1(b)

The other frequency control connection permits external programming of the Frequency Control circuit so that different frequency spans (up to 100% of the available band) and center frequencies may be established remotely. The internal sweep is used and two separate controls establish the center frequency, f_c, and the total frequency span, Δf. These controls function the same as the panel controls VARIABLE FREQUENCY MARKER and ΔF except that Δf is extended to permit a 100% sweep. Terminals B and C must be linked.

Remote Freq. Control... cont'd.

Both controls are linear so that full travel of each pot. relates to 100% of the frequency range of the plug-in being operated. The connections are shown in Figure 2 and the indicated resistance values of 50 K and 2 K must be observed for best performance.

The WILTRON Model 6111 Frequ Programmer provides 10 swept f quency programs selectable with a panel switch. The unit connects to rear of the Model 610B and each pr gram is preset by the user to the d sired frequency range.

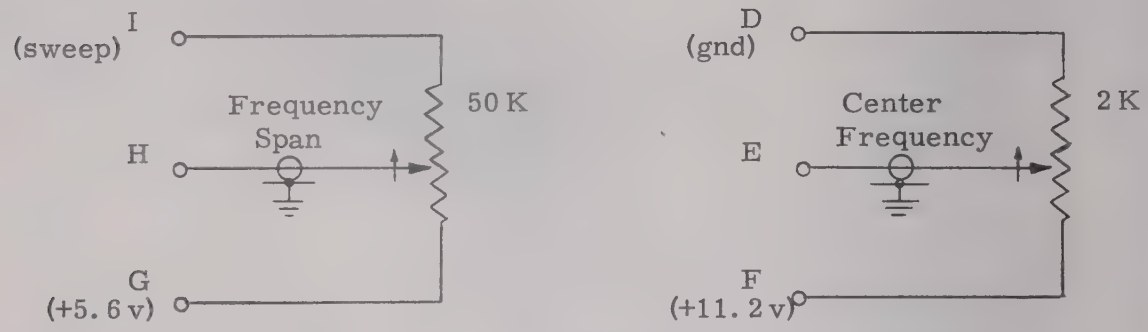


FIGURE 2

 (Pages 15 and 16 are blank)

-1 GENERAL

The WILTRON Model 610B is a master support unit for various plug-in Frequency Generating Units. It supplies a standardized control voltage for setting frequency with calibrated sweep rates; level regulating circuits for maintaining a uniform output power level; modulation circuits; detection and frequency marker circuits; and stable regulated power supplies. Because of the broad frequency coverage of the various plug-ins different methods of frequency generation and level control are used. The following theory of operation describes generalized characteristics of the plug-ins with specific refinements referred to in the Theory of Operation Section for each plug-in.

3-2 SWEEP GENERATOR

The basic elements of the SWEEP GENERATOR are shown in Fig. 6A. The Miller Integrator consists of the amplifier Q104, Q105, Q106, the feedback capacitor C_T, and the charging current i_t set by R_T and -E. The Integrator is controlled by the state of the Schmitt Trigger via CR105 and R116. The output of the integrator is attenuated and voltage offset by the resistive divider and coupled through Q107 and R108 to the Schmitt Trigger input.

A sweep is initiated when Q103 turns on and opens CR105. The current i_t must now be supplied by C_T and a voltage linearly increasing with time begins developing across C_T. The high gain amplifier Q104, Q105, Q106 provides this same voltage so that the input to the amplifier remains essentially constant in voltage level. The charging current i_t is then constant and the voltage at the output of the amplifier is a linear ramp with time.

Sweep Generator- cont'd.

The ramp continues until the portion of it coupled back to the input of the Schmitt Trigger reaches the upper hysterysis level (UHL) and causes a change of state. With Q103 off, CR105 closes and R116 provides a current of about seven times i_t. The integrating process now reverses and C_T charges negatively (in a linear manner) at about six times its charge rate. This continues until CR104 closes and drains the current excess above i_t. This causes the output to cease movement and establishes a stable starting level for each sweep.

Fig. 6B shows the generated sweep voltage and the emitter voltage of Q107 which controls the Schmitt Trigger. This timing waveform shows how the emitter of Q107 is picked up at t_2, carried up with the ramp until it reaches the UHL causing the ramp to reverse at t_3, and falls along the slower time constant of R_{Ho} C_{Ho} until the LHL is crossed at t_5 causing another sweep to initiate.

By raising the clamp voltage on CR106 the emitter of Q107 can be prevented from reaching the LHL and the sweep cycle will cease and wait. This is the triggered mode and the waveform is shown in Fig. 6C. Refer to the full schematic 610B-100. Q101A and Q101B form a Schmitt Trigger which gives a uniform output for all input signals exceeding 1 volt. C103 differentiates this into a trigger pulse and CR102 and CR103 couple only the negative trigger through C104 to the input of Q102. If the sweep is in a recovered state the trigger will cross the LHL and initiate a sweep cycle, eg t_1, and t_5 in Fig. 6C. Manual triggering is accomplished with S103 which discharges the hold-off capacitor when pressed.

Sweep Generator - cont'd.

Upon release the discharged capacitor pulls the emitter of Q107 negative causing the LHL to be crossed and the sweep to start.

Transistors Q108 and Q109 are on during the sweep and off otherwise giving at J102 a voltage near zero during the sweep and +30 volts otherwise. This can be used for timing or blanking other equipment synchronous with the sweep. The voltage from Q111 is +28 volts during the sweep, near zero volts otherwise and is used to deactivate both the RF source and the level loop during the blanking period.

The Sweep Vernier, R134, is normally returned to about -18 volts and reduces the sweep rate by at least 10 to 1 as the voltage is reduced. The Field Effect Transistor, Q104, provides a very high input impedance so that slow sweeps can be achieved with reasonable sized capacitors. The Sweep Bias Adjustment, R126, corrects for the FET bias so that with zero volts on the sweep vernier the ramp will continue to move forward at a very slow rate. This permits intensification of an oscilloscope display by causing the spot to dwell for a period. The Variable Marker circuit, schematic 610B-300, provides the sweep vernier voltage and drops it to -5.0 when intensification is required.

In MANUAL SWEEP mode, R144 provides the sweeping voltage to following circuits and S101B2 forces both Q102 and Q103 to be off. This keeps the integrator at its starting point and sets all blanking outputs as if the sweep were on.

6-3 FREQUENCY INSTRUCTION

The sweep voltage from S101 is clamp between two reference voltages for th purpose of establishing accurately the levels traversed by the sweep and t create a short dwell period at each e for the circuits to respond to the blan signals. See Fig. 6D. The upper end clamped to the +11.2 supply voltage a the lower end to a voltage equal to the ward drops of CR202 and Q201. Each voltage is adjustable and temperature pensated so that the output of Q201 ca set to traverse from zero to the voltag the +11.2 supply.

The truncated sweep voltage is attenua to 0 to 10 volts and supplied as the Ho zontal Output. It also drive the two po tiometers for setting F1 and F2. The rent variations on the +11.2 volt suppl caused by the sweep are cancelled by t action of Q202 which provides an equa and opposite variation. Since the 11.2 volt supply is the reference for both +3 and -20 this sweep ripple correction apparent on all supplies.

Fig. 6D shows the connections betwee the frequency controls and the differen amplifier Q203, 4, 5 for F1 to F2 opera The transistors Q204 and 5 are curren sources for the amplifier. The amplif output is 0 to +10 volts for a 0 to 100% dial frequency sweep. The output can represented as $10[x+(y-x)F_{(t)}]$ where x and y are the percent of full dial settin of F1 and F2 respectively and $F_{(t)}$ rep sents a 0 to 1 linear sweep function. diagrams of Fig. 6E show the operatio of this differential amplifier graphicall Note that if F1 is set above F2 the circ functions as before and the output trave from the higher to lower value.

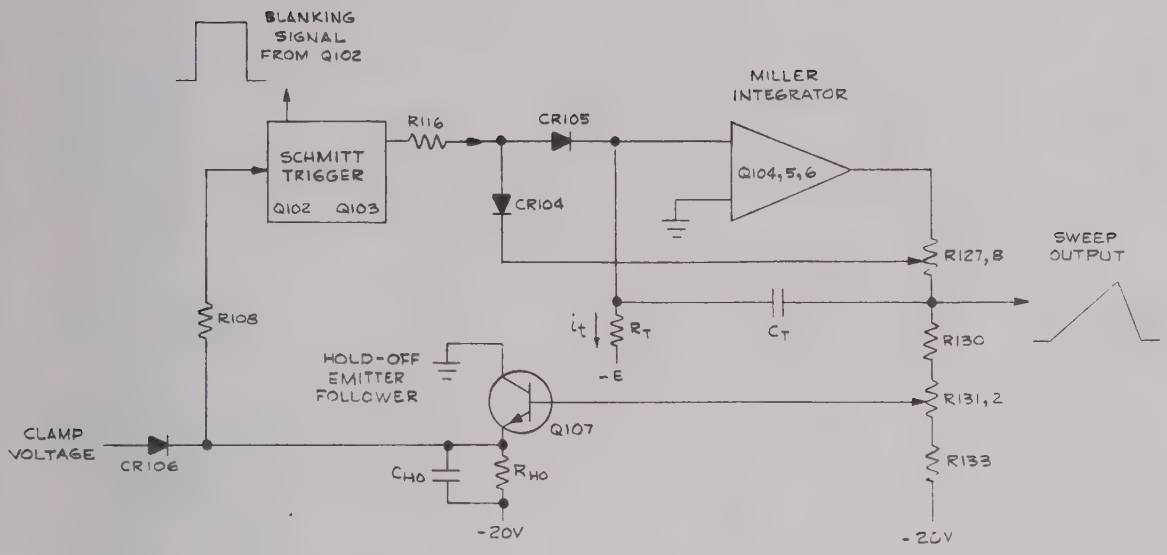


Figure 6A

BASIC ELEMENTS OF THE SWEEP GENERATOR

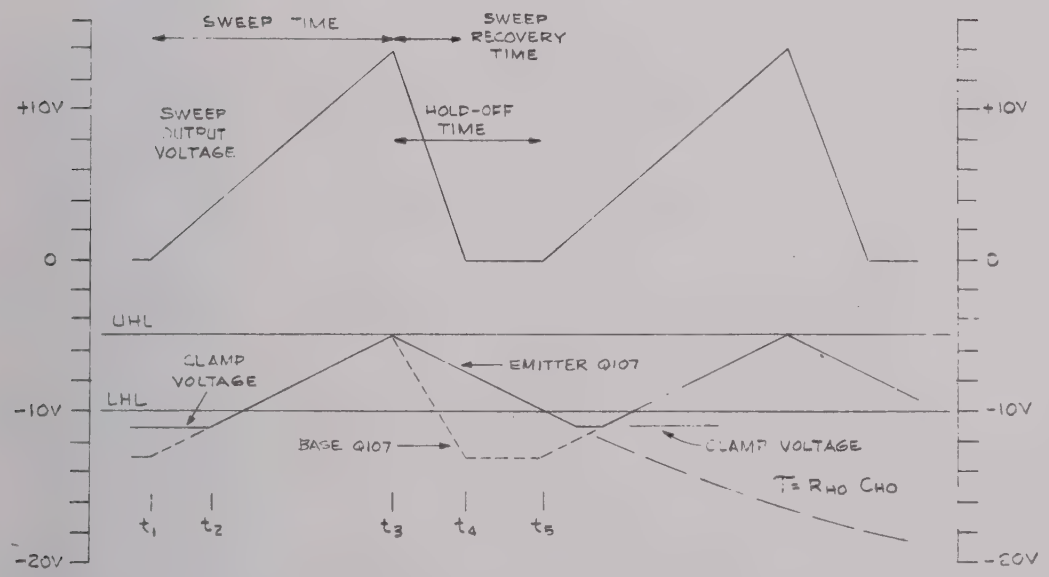


Figure 6B

FREE RUNNING SWEEP WAVEFORMS

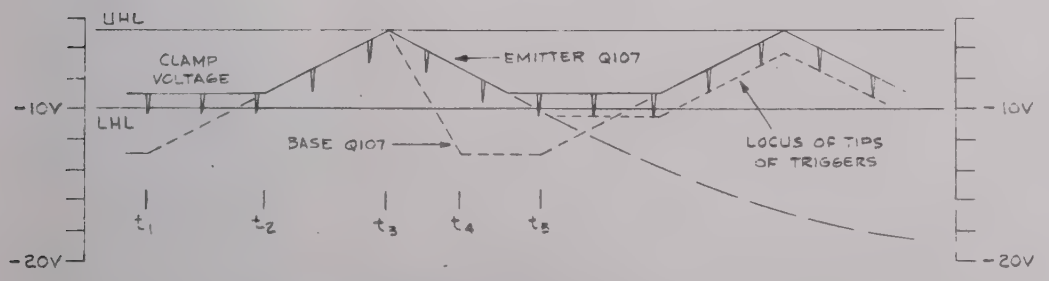


Figure 6C

TRIGGERED SWEEP WAVEFORMS

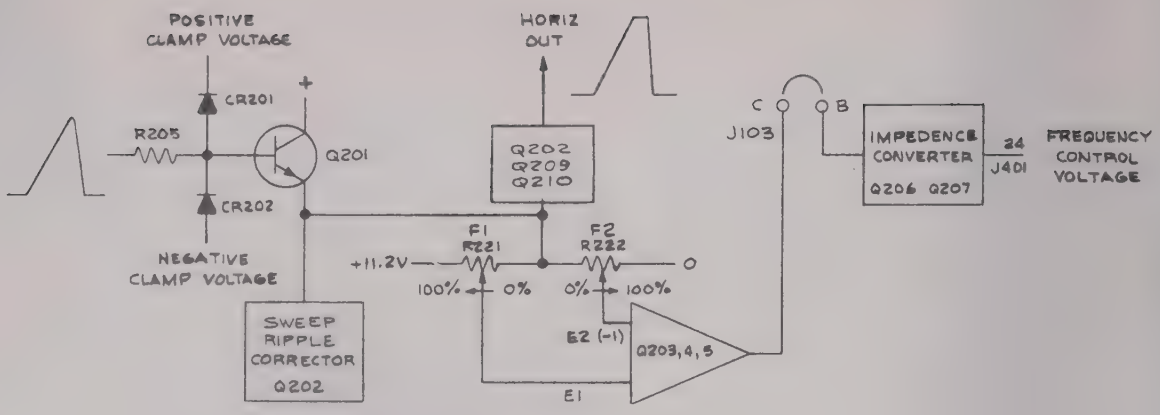


Figure 6D

FREQUENCY INSTRUCTION BASIC CIRCUIT

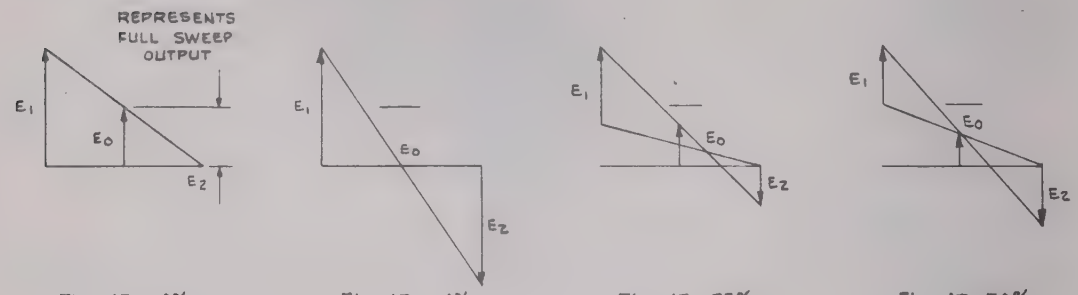


Figure 6E

FREQUENCY INSTRUCTION SUMMING DIAGRAMS

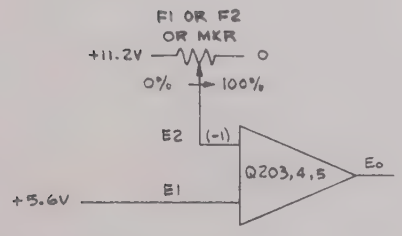


Figure 6F-1

FREQUENCY INSTRUCTION CW OPERATION

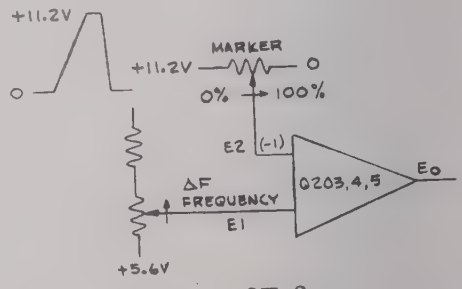


Figure 6F-2

FREQUENCY INSTRUCTION ΔF OPERATION

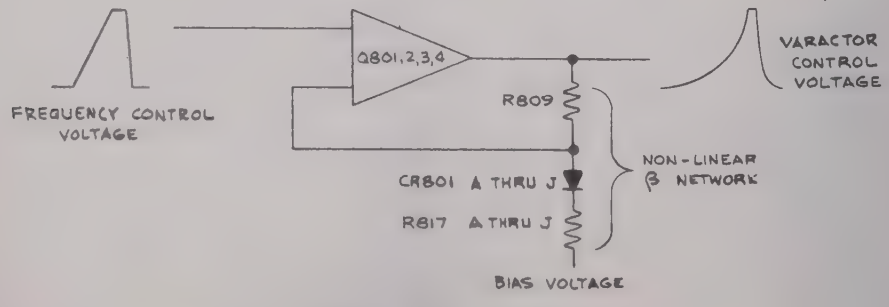


Figure 6G

FREQUENCY CONTROL BASIC CIRCUIT

equency Instruction - cont'd.

V operation is similar with the appro-
iate Frequency Control providing a vol-
ge proportional to the dial setting for one
ut and +5.6 (one-half of the 11.2 volt
pply) connected to the other input. The
lector switch, S2-1B2, changes the two
rrent sources, Q204 and Q205, to cor-
ct for a 5 volt offset in the output voltage
ich would otherwise occur. Figure 6F1
ows the CW connection and Fig. 6F2
ows the ΔF operation. ΔF functions the
me as CW except that the +5.6 voltage
caused to sweep equal amounts above
d below in proportion to the ΔF Frequency
ntrol setting. The calibration is in per-
nt of full dial.

e Remote position of the Frequency Se-
tor Switch connects the circuit for ΔF
eration with connections to the rear ter-
nal strip J103 where two potentiometers
ay be connected. See section
ese controls function the same as the
nel controls ΔF Frequency and Marker;
wever, ΔF can now be set for any sweep
an up to the full capability of the plug-
use.

e 0 to 10 volt output of the Frequency
struction circuit is wired to Terminal C
J103, back in term B and through the
pedance Converter Q206, 207. This
cuit is adjusted for no voltage offset
d has 98% transmission. This voltage
eds the Frequency Control circuits of
e Plug-in and the Variable Frequency
arker circuit. The link is removable
om terminal B of J103 so that an exter-
l voltage may be introduced for remote
ntrol frequency. Resistance control
ay also be used by using Terminal A.
10K potentiometer connected from A to
ound will have 10 volts across it and
th its slider connected to terminal B
ll have direct frequency proportional
the potentiometer setting. A 1K value
ay be used by opening R219.

FM is obtained by coupling the external ac signal through C202 and R217 to the Frequency Control signal. Since the output frequency is directly proportional to this voltage the FM deviation will be essentially constant across the full band of the plug-in. When using Ext. FM together with remote frequency control on terminal B the impedance connected to terminal B should be raised to near 50K ohms by adding a series resistor to aid the coupling of low frequency FM signals.

6-4 FREQUENCY CONTROL

This section is a generalized discussion of the shaping circuit used with the varactor tuned oscillators. The theory of Operation section for the particular Plug-in will note any deviations. See Figure 6G for the basic circuit configuration.

The linear control voltage is fed to one input of the operational amplifier formed by Q803, 4, 1 and 2. The ouput is attenuated and fed to the other input. This negative feedback causes the gain of the amplifier to be the inverse of the attenuator characteristic. The attenuator is made non-linear by means of (typically) ten diodes each biased at a voltage between 0 and +10 volts. As the control voltage reaches each of the bias levels the corresponding diode starts to conduct lowering the impedance level of the lower part of the attenuator. Thus the output voltage changes to a steeper slope until the next diode closes. The resultant output voltage is composed of eleven straight line segments that very closely synthesize the non-linear varactor tuning voltage. The different bias voltages for the shaping diodes set the frequency where bending commences and the series resistance, R817, establishes the slope.

The ten resistances of R817 are selected for the particular oscillator in the plug-in.

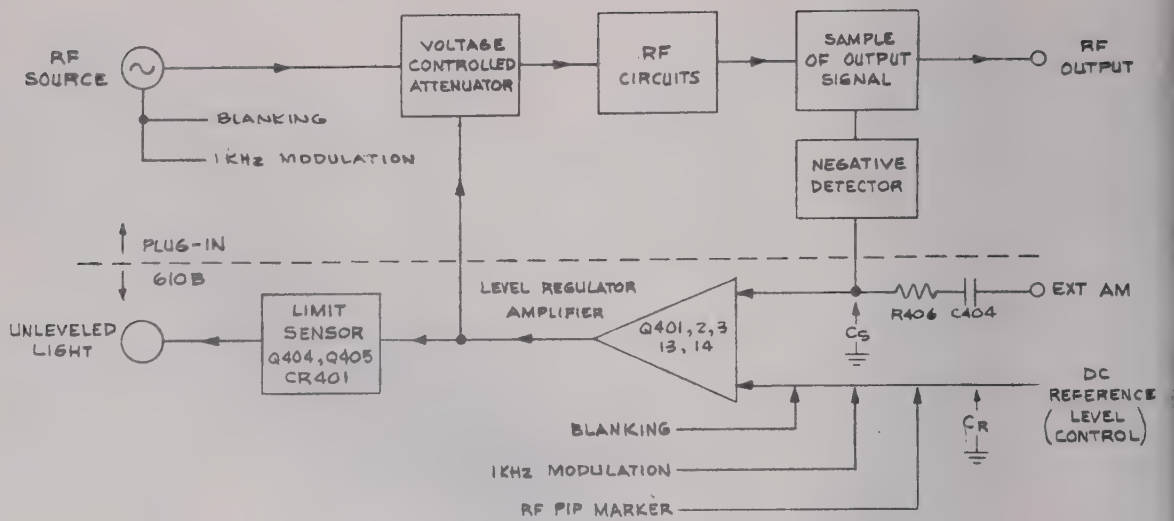


Figure 6H

LEVEL CONTROL BASIC CIRCUITS

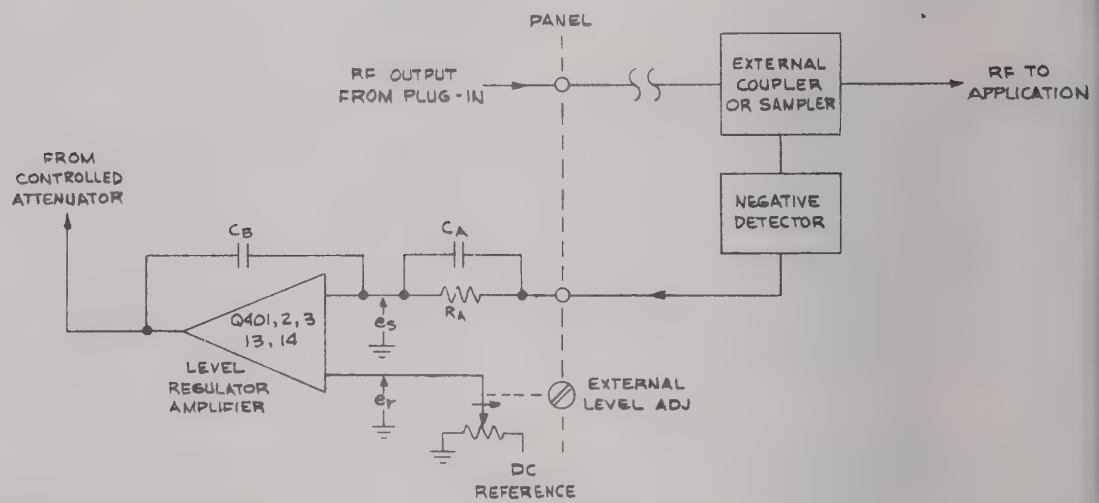


Figure 6I

EXTERNAL LEVELING BASIC CIRCUITS

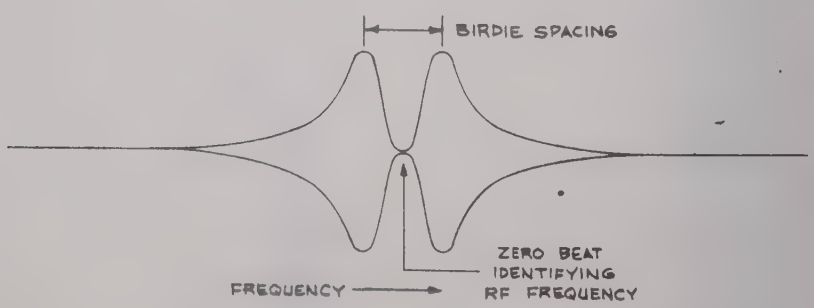


Figure 6J

BIRDIE MARKER ENVELOPE

OUTPUT LEVELING

e output signal is maintained level by nitoring and using electrical feedback a voltage controlled attenuator. This ne circuit is used to apply amplitude dulation to the signal.

e basic circuit configuration is shown Fig. 6H. A fraction of the output signal taken by the sampler which in many plug- is a coupler. This signal is converted negative dc voltage e_s with a flat fre- ency response detector. A high gain erational amplifier compares e_s with a ference voltage e_r and delivers a suitable ive to the voltage controlled attenuator make e_s equal e_r. With this control p operating the output signal will be as t as the characteristics of the sampler d the detector.

ternal amplitude modulation is accom- shed by summing the modulation signal th the detector output to provide e_s. The verted modulation signal is imposed on the R. F. signal so that the sum of the tected R. F. plus the modulation signal uals e_r. It is apparent that sine wave dulation requires increased output at e peaks so that e_r, established by the el Control, must be reduced to stay thin the power output rating of the plug-

ternal modulation is accomplished with the Hz square wave applied to e_r causing the tected R. F. to follow the instantaneous lue of e_r. The 1 kHz oscillator is a free- nning multivibrator, Q406 and Q407, with e output taken through CR404. The pulse m the variable frequency marker is also plied to e_r to cause a momentary dip in the F. level.

Output Leveling - cont'd.

When the RETRACE R. F. is turned off the blanking + signal pulls e_r to ground potential or slightly positive so that the voltage controlled attenuator is held in a high attenuation state during the retrace time when the R. F. signal is absent.

Whenever level control cannot be maintained the feedback loop will force the output of the amplifier to either its positive or negative extreme. At its positive limit (about +1. 5 volts) CR401 conducts and Q405 activates the Unleveled Light. At the negative limit (about -18 volts) Q404 is turned off and the light is powered. The blanking-signal is used to deactivate Q405 when the Retrace RF is off.

External leveling connections are shown in Fig. 6I. The elements $C_A R_A$ and C_B control the loop response to maintain stability and are a part of the plug-in. With crystal leveling a negative detector must be used. The External Level screwdriver adjust varies the dc reference to mate to the sensitivity of the external detector and acts as a level control. Detector voltages below 50 mv will give leveling but large larger voltages will give flatter performance because of higher loop gain. In the Power Meter position of the Modulation selector a 1K resistor is provided across the input terminal to satisfy the load requirement of a typical power meter. In addition the stabilizing network is changed to accommodate the very slow response time of the power meter.

6-6 INTERNAL DETECTOR

Schematic 610B-300 shows the internal detector composed of CR308, R313 and

n addition, the 1 kHz square wave and the Blanking - signal are applied directly to the source to insure 100% AM modulation on INT AM and zero RF output during blanked trace.

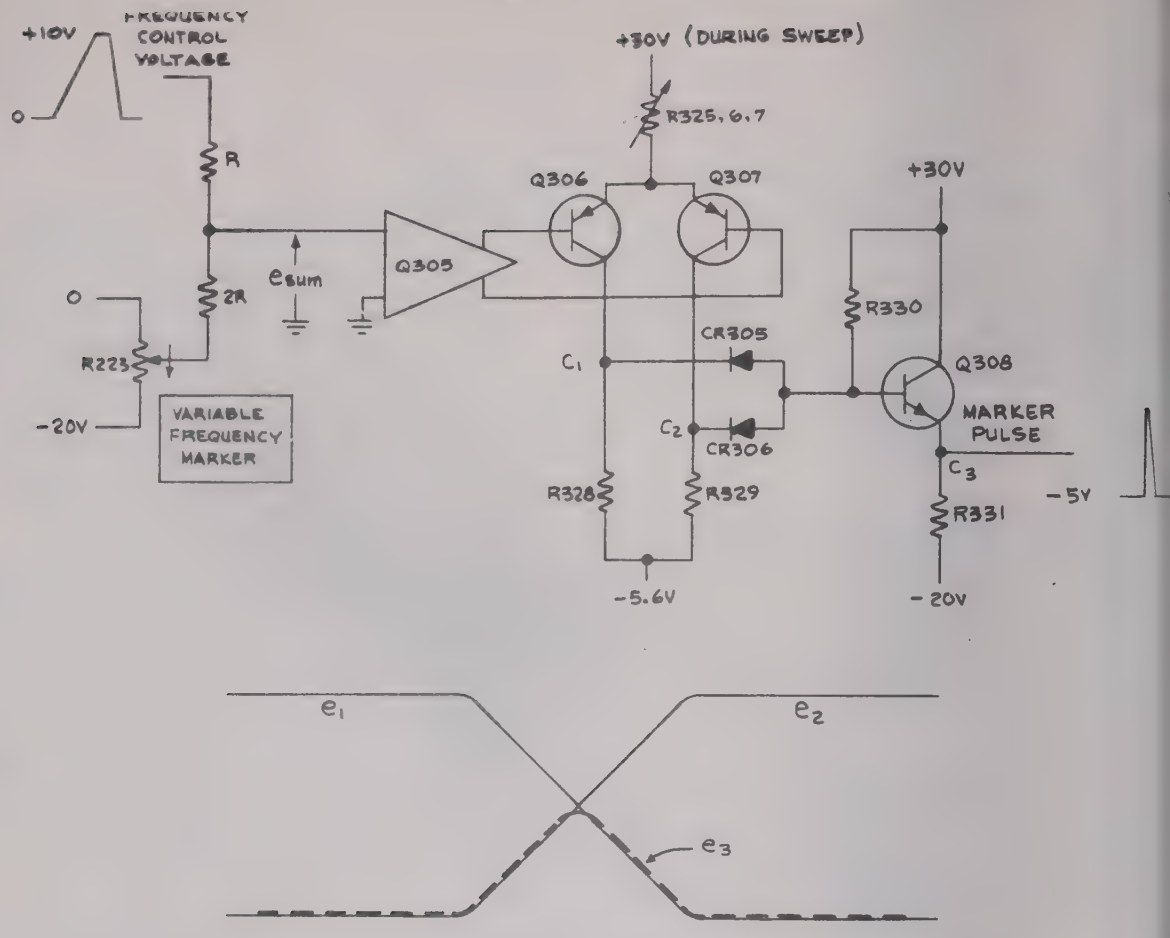


Figure 6K

VARIABLE MARKER COMPARATOR and PULSE SHAPER

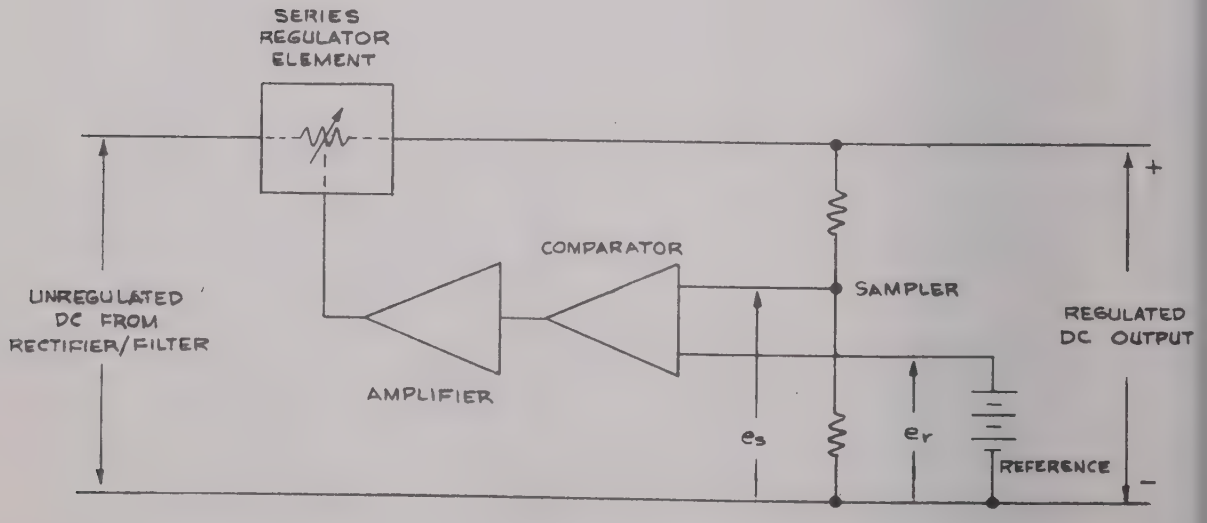


Figure 6L

BASIC POWER SUPPLY REGULATOR

ternal Detector - cont'd.

310. The circuit is in a configuration hich holds the flatness, VSWR and sen- tivity good from 50 KH_Z to over GH_Z. he output of the detector is coupled rough R315 to the Vertical Output jack. rovision is made for coupling the output an external detector to the same jack.

7 MARKERS

wo marker systems are a part of the odel 610B; the Birdie Markers and the ariable Frequency Marker. The charac- ristic double peaked response of the rdie marker, see Fig. 6J, is coupled the Vertical Output jack for display on e detected R. F. During retrace time 304 shorts out the birdie signal to pro- de a clean base line. See Schematic 0B-300. The Variable Frequency mark- (VFM) provides an identifying mark on e display for a dial setting. The output the VFM is a positive going pulse which coupled through the amplifier Q303 to ace a narrow negative notch on the detec- r output when the VFM switch is in the deo position. In the R. F. Pip position e pulse is coupled through CR307 to mo- ntarily drop the level reference voltage using the R. F. output to dip. In the in- sity position the display is brightening the oscilloscope trace by the amplifier 09 and 310 acting to slow the sweep prog- s s momentarily thus permitting the ctron beam to dwell and produce a brighter ot. This intensification is also present en the R. F. Pip and Video positions are ed.

e Variable Frequency Marker functions h all plug-ins using the basic circuit as own in Fig. 6K. The resistors R and 2R m two voltages of opposite polarity, the quency control voltage and a dc voltage portional to the marker dial setting. e sum, e_S is zero when the Frequency Control voltage corresponds to the marker setting. The comparitor Q305 is a stable hi-gain linear amplifier which is followed by a differential amplifier Q306, 307. As the sweeping Frequency Control voltage causes e sum to cross zero the current in the differential amplifier makes a linear transition from Q306 to Q307. The collector voltage e_2, shown in Fig. 6K moves from -5.6 to a more positive value set by R329 and R325, 6, 7. The voltage e_1 simultaneously makes the opposite transition. The diode logic of CR304 and 306 couples the more negative of the two waveforms to the emitter follower, Q308, which thus shapes the variable marker pulse. By changing the available current with R326 the magnitude of the pulse is controlled. The high gain employed produces a very narrow marker only 0.4% of the dial width at its base for full amplitude and becomes more narrow with reduced amplitude.

Control of the sweep rate by the marker for instensity display is accomplished with Q309 and 310. These transistors form an amplifier with dc offset which provides the voltage for the Sweep Vernier control. The normal level is -18 volts which drops to -0.5 during the marker when the amplitude is at maximum. This reduces the sweep charging current causing the sweep to slow as the marker shape is generated.

The birdie markers are derived from the mixer shown on schematic 610B-001. All the plug-ins have internal provision for feeding a part of the output R. F. to this mixer to provide birdie markers. This internal R. F. is mixed with R. F. from up to seven single frequency oscillators, a harmonic train of R. F. frequencies or external R. F. applied at the front panel. The diode CR11 provides the non-linear mixing action and the beat frequency is brought out through the filter C11 and R32.

Markers - cont'd.

The beat frequency is enlarged and shaped by the tuned amplifier Q301, schematic 610B-300, to give the typical birdie shape shown in Fig. 6J. This amplifier is single tuned giving a response peak at its center frequency. The biridie has two peaks since it crosses the amplifier response twice; as the sweeping R. F. approaches the marker from below and again as it passes beyond. The spacing between peaks is 14 KH_z in the Narrow position and 200 KH_z in the Wide. The tuned circuitL302 and C304 sets the wide response. In narrow operation the tuned circuit L301, C303 and R308 is followed by a filter section R356 and C304 to make the birdie fall off faster with frequency, giving a more narrow response than a single tuned circuit. An untuned amplifier Q302 gives further magnitude which is controlled for display with the Marker Amplitude attenuator, R311.

Two marker widths are provided for usage with both wide and narrow sweeps. The wide marker should always be used when sweep width permits because it receives greater energy and typically produces a larger marker. The markers will improve in appearance when slower or narrower sweeps are used because the transition rate in MH_z/sec through the birdie amplifier spectrum is reduced permitting the birdie envelope to contain more cycles of beat frequency energy.

The Harmonic Marker Generator accessory which fits into the 610B frame contains four crystal oscillators which are coupled through two buffer amplifiers to a step recovery diode. Only one oscillator is biased on the dc current which is overcome with the R. F. drive signal. During the reverse bias period the diode continues to conduct as the stored charge is swept out. This reverse current suddenly drops to zero because of the particular doping of the junction, creating a sharp voltage step which is rich in harmonics of the R. F. drive signal. The diode voltage is coupled to the output 50 ohm coax. The generator that provides the fundamental frequency is a 1 MHz crystal oscillator. The multivibrator provides the necessary rapid drive signal for the step-recovery diode.

The SINGLE FREQUENCY MARKER unit consists of a crystal oscillator and an emitter follower. The output is lightly coupled to a 50 ohm coaxial line which passes through the unit. Successive units are connected in series with a 50 ohm termination on the last, and the first connected to the birdie mixer.

6-8 POWER SUPPLIES

The two primary supplies are +30 and -20 volt and are designed for low ripple and high stability in the presence of temperature variations. Both supplies are fed by a bridge rectifier with a capacitor filter and follow the basic regulator circuit shown in Fig. 6L. The output voltage is sampled by a resistive voltage divider and is compared to a voltage reference. A differential amplifier is used for a comparitor so that temperature effects are cancelled. Any difference voltage between e_s and e_r is sensed by the comparitor and amplified. Another amplifier provides further gain to drive the series regulator element which completes the feedback loo The series element changes its conductance until e_s is equal to e_r. Note that the negative output terminal may be grounded to make a positive supply or the positive supply or the positive terminal grounded for a negative output. Also e_s and e_r ma be referenced to the positive lead with the amplifier output phase inverted to retain the negative feedback.

Power Supplies - cont'd

The +30V supply obtains its sample with R510 and R513 which is compared by Q506 to the reference +11.2V Super Regulated Power Supply. The amplifier, Q503 and 504, provides high gain for tight regulation and C508, R514 provide frequency compensation to maintain the loop stable. The driver transistor Q502 provides the current gain for controlling Q501 the series regulator transistor.

Current limiting to protect against short circuit overload is provided by R503, 504, and 508. When shorted the proper action of the regulator is to turn on Q503 to provide the short circuit currents. The voltage drop across R503 is proportional to this current and cannot exceed the drop across R504 because of the control of Q502. This drop is limited to the available current from Q503 which is set by R508. Thus the short circuit current is limited and Q501 is protected against excessive dissipation. The diode CR509 compensates for the base-emitter drop of Q502 to maintain the current limiting uniform with changing temperature.

The -20V supply works in the same manner as the +30V supply. It is referenced from the -6.2V ±5% Temperature, compensated zener diode, CR519.

The +11.2V Super Regulated Power Supply is referenced from CR521, a +6.2V ±5% temperature compensated zener diode. R539 and R540 provide the supply sample that is compared to the zener diode voltage. Loop gain for the +11.2V supply regulator is obtained from a μa 709 integrated circuit operational amplifier, Q506. The output of Q506 controls the current through Q512 the series device for the +11.2V supply.

R543 provides current limiting protection for Q512 in case of a short circuit or a current overload on the +11.2 supply buss. CR523 protects the inputs of Q506 from excessive offset voltages which could damage the integrated circuit.

The +5.6V supply is referenced from the +11.2V supply by R544, 545, and 546. The series device Q513 is driven by a differential amplifier consisting of Q514 and Q515. R547,548 and 549 provide current limit protection for Q513 in a manner similar to that described above for the +30V supply.

The -5.6V supply is provided by an emitter follower referenced from the -20V supply. CR520 compensates the reference divider for changes in the emitter to base voltage of Q516 with temperature and helps to maintain a -5.6V output with changes in temperature constant.

The high voltage power supply sets on top of the +30V supply and is programmed by the plug-in in use to provide between +40 and +140V with respect to ground. The comparator-amplifier Q411, 412 has +30V for its reference and the sampler is composed of R443, 444 and R801 in the plug-in. The driver transistor is composed of Q408 and Q409 in series to achieve a high voltage rating. The series transistor, Q410, will regulate up to 40 milliamperes at any output voltage between 40 and 140 volts. Frequency roll-off to control the feedback loop stability is provided by C412. Short circuit protection is established by R435, 439 and 445 in the same manner as the other supplies.

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SECTION 7 RECALIBRATION PROCEDURE

MODEL 610B

In this procedure it is assumed that the circuits being recalibrated are functioning. If the circuits are inoperative or operating improperly, refer to Section 7-17 for a recommended trouble shooting procedure. As an aid in trouble shooting the 610B, a simplified signal flow diagram is given at the beginning of Section 7-17. This diagram shows the major signal flow route in the 610B and indicates the key waveforms that should be used in isolating a problem to a particular stage.

The below Sections 7-1 through 7-6 are sequential and should be followed in that order. Make all tests and adjustments with a plug-in unit installed. Remove the top dust cover of the 610B for access to the printed circuit card socket test points. Unless specified otherwise, all d.c. measurements are made with the chassis as ground reference.

7-1 SETTING OF THE 610B FRONT PANEL CONTROLS

Set the front panel controls as indicated below.

FREQUENCY CONTROL: to CWF1

F1: 10% up from left end.

F2: at 100%.

SWEEP TIME: .01 sec per sweep.

SWEEP TIME VERNIER: CAL.

SWEEP MODE: AUTO.

VAR FREQ: INTENSITY.

VAR FREQ MKR AMP: CCW.

MODULATION: NORMAL.

BIRDIE MKRS AMPLITUDE: CCW.

(6108 PLUG-IN: HI BAND)

Allow 15 minutes warm-up time.

7-2 POWER SUPPLY RECALIBRATION

a) Check for proper voltage at indicated test points using .02% d.c. voltmeter. These test points are at the socket connectors of printed circuit board 610B-5B

Only if these voltages are not within range, see Section 7-9 for Adjustment Procedure.

Pin 1 610B-5B - - - +30V ±10 mv

Pin 5 610B-5B - - - +11.2V ±5mv

Pin 7 610B-5B - - - +5.6V ±5mv

Pin 9 610B-5B - - - -5.6V ±5%

Pin 18 610B-5B- - - -20V ±10 mv

Pin 2 J401 - - - high voltage required by plug-in installed in the instrument ±5%.

NOTE:
In some older instruments the +11.2V Power Supply Voltage is produced by two 5.6 V Zener diodes in series. These diodes are matched in breakdown voltage to within ±20 mv of each other. If these diode voltages are out of tolerance, the diode assembly should be replaced. It is recommended that this be done at the factory.

b) Measure the ac ripple and noise on all supply voltages at the points indicated in part a. Using a Tektronix 503 or other oscilloscope of comparable sensitivity, the ripple and noise on all supplies (except the HIGH VOLTAGE SUPPLY) should be less than 1 mv P-P. The ripple on the HIGH VOLTAGE SUPPLY should be less than 5 mv P-P. If the ripple and/or noise on any of the supply voltages is greater than the above values, see Section 7-17 for trouble shooting procedures.

7-3 SWEEP GENERATOR RECALIBRATION

Set the FREQUENCY CONTROL - F1 to F2 All other controls are as in 7-1.

a) Connect the Vertical Input of a d.c. oscilloscope to Pin 2 of the 610B-3A printed card socket and check for the sweep waveform as shown in Fig. 7A below.

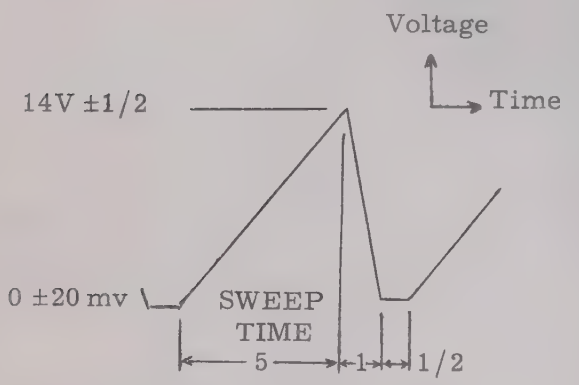


Figure 7A

SWEEP WAVEFORM AT PIN 2 610B-3A

b) With the SWEEP VERNIER on CALIBRATE, check the sweep time on all sweep ranges against the calibrated oscilloscope time base. Sweep times should be within ±20% of dial indication. The relative times for sweep return and hold off, as indicated in Fig. 7A, are ±20% values.

If any of these values are out of tolerance see Section 7-11 and 7-12 for adjustment procedure.

c) Set the SWEEP MODE to LINE and repeat step (b) above. Set the scope trigger source to Line and check the sweep waveform's synchronization with the sweep of the scope. Turn the SWEEP TIME VERNIER through its full range and check for smooth change in sweep time and for at least a 10 to 1 range of control. If adjustments are necessary, see Section 7-11.

d) SET SWEEP MODE to TRIG. and observe that there is no sweep. Press push button on front panel and observe single sweep with each release of button. With a 1V Peak to Peak 10 Hz square wave applied at TRIGGER IN at the rear of the instrument a normal sweep should be observed.

7-4 SWEEP DRIVER RECALIBRATION

Set the FREQUENCY SELECTOR knob in the F1 to F2 position and all other controls as specified in Section 7-1.

a) Connect the output of PIN I of J103 to the Vertical Input of a d.c. oscilloscope (J103 is located on the rear panel of the instrument.) The waveform observed should be the same as the one shown in Fig. 7B.

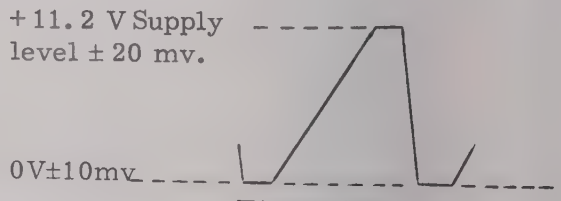


Figure 7B

SWEEP WAVEFORM ON PIN I OF J103

To determine the proper maximum sweep voltage measure the +11.2V supply level on Pin F of J103, using the most sensitive d.c. oscilloscope range possible. Mark this level on the face of the oscilloscope and withou

changing the control settings on the scope, reconnect the Vertical Input to Pin I of J103. The sweep end level of the waveform should be at the same level as the +11.2V mark. If adjustments are necessary, see Section 7-13.

b) MANUAL SWEEP RECALIBRATION

Set SWEEP MODE to MANUAL, FREQUENCY SELECTOR to F1 to F2, and all other controls as specified in Sec. 7-1.

1. Turn the SWEEP MODE VERNIER until the voltage on Pin 1 of J103 is at 0V±10mv. The voltage at the HORIZ. OUT on the front panel should be 0V ±0.2V.
2. Turn the SWEEP MODE VERNIER CW until the voltage on Pin 1 of J103 is at 11.2V ±20mv. The voltage at the HORIZ. OUT on the front panel should be 15V±0.2V. If adjustment of the HORIZ. OUT voltage is necessary see Sec. 7-13.

7-5 FREQUENCY INSTRUCTION RECALIBRATION

a) Dial assembly mechanical inspection.

1. With the F1, F2 and VAR FREQ MKR controls turned fully to the CCW, all three pointers should be within 1/32" alignment and approximately 1/16" to the left of the scale calibrations.

2. With the above controls turned fully CW, the three pointers should be 1/16" beyond the right end of the scale and have a maximum deviation in position of 1/16".

3. If dial pointers are out of tolerance, see Section 7-14.

b) Set the F1 and F2 pointers exactly on zero. Set the FREQUENCY SELECTOR control to F1 to F2 and set all other controls as in 7-1.

1. View the sweep signal on Pin C J103 (located on the rear panel of the instrument) with an a.c. coupled oscilloscope. The sweep signal should be less than 20 mv peak-to-peak.

2. With the oscilloscope removed, connect a .02% d.c. voltmeter to Pin C of J103. The d.c. voltage present should be 0V ±10 mv.

3. Remove the lower dust cover and, without changing the control settings, connect the .02% d.c. voltmeter to Pin 24 of J401, located on the rear panel of the instrument. The voltage here should be 0 V ±10 mv.

4. Set the F1 and F2 pointers exactly on 100%. Reconnect the d.c. voltmeter to Pin 24 of J401. The voltage on the d.c. voltmeter should be 9.75V ±20 mv.

5. Set the F1 pointer on 0 and the FUNCTION SWITCH to CWF1. The voltage on the d.c. voltmeter should be 0V ±20 mv.

6. Set the VARIABLE FREQ. MARKER to 5% of the dial reading and the FREQ. SELECTOR SWITCH to ΔF. Turn ΔF control to 5 and observe 500 mv Peak to Peak waveform on Pin C J103 with a d.c. oscilloscope.

7. Set the FREQ SELECTOR control to F1 to F2.
Set the F1 pointer exactly on 0.
Set the F2 pointer exactly on 100%.
Connect the vertical input d.c. oscilloscope to Pin 24 of J401.
The waveform seen should be

as shown in Fig. 7C below. This is the sweep waveform that drives the Frequency Control circuits in the plug-in and it will be referred to in the plug-in recalibration procedures.

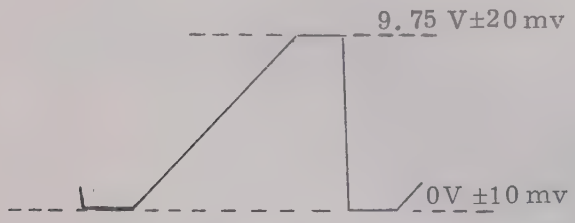


Figure 7C
SWEEP WAVEFORM ON PIN 24 OF J401

8. If any of these voltages are out of tolerance, see Section 7-15 for the adjustment procedure.

7-6 VARIABLE FREQUENCY MARKER RECALIBRATION

Set the FREQ SELECTOR control to F1 to F2 and the VAR FREQ MKR AMP control to VIDEO
All other controls are set as in Section 7-1.
Connect the oscilloscope as shown in Fig. 7D.

a) Set the F1 pointer at 0% of the dial range.
Set the F2 pointer at 10% of the dial range and the VAR FREQ MKR POINTER on 5% of the dial setting.
Turn VAR FREQ MKR AMP control CW until the video pip is visible. The pip should be in the central ±5% of the sweep.

b) Set the F1 pointer on 90%.
Set the F2 pointer on 100%, and the VARIABLE FREQ pointer on 95%.
Repeat the check made in step a).

c) If the marker is out of tolerance in either step a) or b), see Section 7-10 for adjustment.

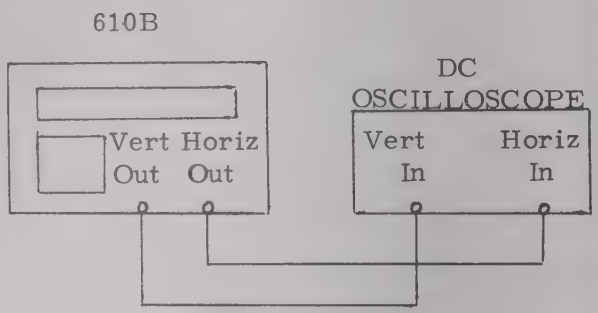


Figure 7D

7-7 LEVEL CONTROL RECALIBRATION

Set front panel controls as in sec. 7-1.

1. With plug-in installed, connect .02% dc voltmeter to pin 10 of J401 (Located on rear panel behind the plug-in). Adjust the RF POWER LEVEL control on the plug-in front panel for -.170V.

2. Connect .02% dc voltmeter to pin 18 of J401. Without changing the plug-in power level control, the voltage on pin 18 should be within ±2mv of the voltage recorded in step 1. above. If this voltage is out of tolerance see sec. 7-16A.

7-8 HARMONIC MARKER RECALIBRATION

Remove the bottom dust cover of the 610B. Unhook the BNC cable from the 61HH or 61H Harmonic marker generator at the Birdie Marker Mixer located on the rear panel of the instrument and connect to HP5246L Electronic Counter. Put both 1 and 10MHz and the 50 and 100 MHz toggle switches to their center positions.

a) Throw the toggle switch on front panel to 10MHz Harmonic and observe the frequency of 10MHz ±1kHz from the Marker Generator.

b) Throw the toggle switch to 1MHz Harmonic and observe the frequency of the 1MHz ±100Hz from the Marker Generator

c) Put 1 and 10MHz toggle switch to its center position and throw the second toggle switch to 50MHz. Observe the frequency of 50MHz ±5kHz from the Marker Generator.

d) Throw the second toggle switch to 100MHz. Observe the frequency of 100MHz ±10kHz from the Marker Generator.

e) If any of the marker generators are out of tolerance, see Sec. 7-16B for adjustment.

ADJUSTMENT PROCEDURES

The adjustments described in this section are to be made only if the voltages and waveforms described in the RECALIBRATION PROCEDURE are out of tolerance. Random adjustment of the internal controls without reference to the recalibration procedure will cause a deterioration of the instrument's overall calibration and accuracy. Most of the internal adjustments are made on controls located on the printed circuit cards mounted on the under side of the main deck. Remove the bottom dust cover for access to these internal adjustments. A card extender is available for access to the adjustable components located on the printed circuit cards.

7-9 POWER SUPPLY ADJUSTMENTS

Set controls as described in Section 7-1.

a) Monitor the +11.2V power supply at Pin 5 of the socket connector of the printed circuit board 610B-5B. The +11.2V supply is adjusted with R537 on the PC 610B-5B. Using a .02% d.c. voltmeter, set the +11.2V supply for 11.200V ±1mv.

Monitor the +5.6V power supply at pin 7 of the socket connector of the printed circuit board 610B-5B. The +5.6V supply is adjusted with R545 on the PC 610B-5B. Using a .02% d.c. voltmeter, set the +5.6V supply for 5.600V ±1mv

Note: Changing the +11.2V supply voltage will require resetting the +30V and -20V supplies. See steps b and c below.

Power Supply Adjustments - Cont'd.

b) Monitor the +30V power supply at Pin 1 of the socket connector of the printed circuit board 610B-5B. The +30V power supply is adjusted with R512 on PC 610B-5B. Using a .02% d.c. voltmeter, set the +30V supply for +30V ±6mv. Changes in the +30V supply may also affect the -20V supply and it should subsequently be checked after adjusting the +30V supply. Monitor the -20V power supply at Pin 18 of printed circuit board 610B-5B.

c) The -20V power supply is adjusted with R524 on PC 610B-5B. The -20V supply should be adjusted only after the +30V supply has been checked. Using a .02% d.c. voltmeter, set the -20V supply for -20V ±4mv.

d) There are no control adjustments for the High Voltage power supply. If this supply is operating improperly, see Sec. 7-17 for Trouble Shooting procedures.

7-10 VARIABLE FREQUENCY MARKER ADJUSTMENTS

Set controls as indicated in Sec. 7-6 and connect the d.c. oscilloscope as shown in Fig. 7C.

a) Set controls as described in Sec. 7-6a. Adjust R322 BALANCE on Pc 610B-2a to place the marker in the center of the sweep ±5%.

b) Set controls as described in Sec. 7-6b. Adjust R317 CALIBRATE on PC 610B-2a to place the marker in the center of the sweep ±5%.

c) Repeat steps a and b until no further adjustment is necessary.

d) Connect the Vertical Input of the d.c. oscilloscope to Pin 5 of the 610B-2a printed card socket. With the VAR FREQ MKR AMP control turned full CW adjust R325 MAX AMP ADJ on PC 610B-2a for a peak of +0.6V. See Fig. 7F.

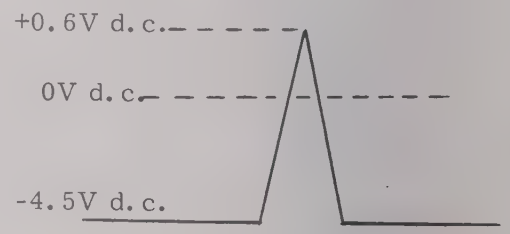


Figure 7F
VIDEO PIP ON PIN 5 OF 610B-2A SOCKET

Variable Frequency Marker Adjustments Cont'd.

e) Connect the Vertical Input of the d. c. oscilloscope to Pin 2 of the 610B-3A printed card socket. With the VAR FREQ MKR AMP control turned fully CW and F1 set on 0% F2 set on 100% full scale, and VAR FREQ MKR set midscale, adjust R341 DWELL ADJUST on PC 610B-2A for a step of 0.4 cm on a 5 cm sweep. See Figure 7G.

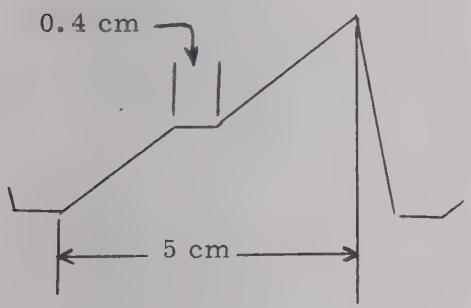


Figure 7G

SWEEP WAVEFORM ON PIN 2 OF 610B-3A

7-11 SWEEP GENERATOR ADJUSTMENTS

Set FREQUENCY SELECTOR to F1 to F2. All other controls set as in 7-1.

Connect the Vertical Input of the d.c. oscilloscope to Pin 2 of the 610B-3A PC socket. and observe the waveform shown in Fig. 7A.

a) Adjust R127 SWEEP START LEVEL on PC 610B-2A for sweep start at 0V ±20 mv.

b) Adjust R131 SWEEP END LEVEL on PC 610B-2A for sweep amplitude of 14V.

c) Turn SWEEP VERNIER (R134) fully CCW and short its wiper to ground. Adjust R126 BIAS ADJUST on PC 610B-3A for slow positive growth of sweep voltage. (NOTE Voltage must not go negative.)

d) Remove short, turn Vernier to CAL and observe sweep. Repeat steps a, b, and c if necessary.

e) Make the following control settings.

FREQUENCY SELECTOR control: F1 to F2.
SWEEP TIME: 1 - .1 sec. per sweep.
SWEEP MODE: LINE SYNC,

Set all other controls as in Sec. 7-1. Connect the Vertical Input of the d.c. oscilloscope to Pin 2 of the 610B-3A PC socket and observe sweep as shown in Fig. 7A. Connect the .02% d.c. voltmeter to Pin 6 of the 610B-3A PC socket.

f) Adjust R138 TRIGGER ADJ, located on the under side of the main deck, until the sweep just stops. Turn the SWEEP MODE control on the front panel to TRIG and record the voltage on Pin 6 of the 610B-3A PC socket.

g) With the SWEEP MODE in the TRIG position, adjust R138 TRIGGER ADJ. until the sweep starts again. This is a free running sweep. Back off on R138 until the sweep just stops and record the voltage on Pin 6 of the 610B-3A PC socket.

h) With the SWEEP MODE still in the TRIG. position, adjust R138 for a voltage on Pin 6 of the 610B-3A PC socket midway between the two voltages recorded in parts a and b ± 50 mv.

i) After adjusting R138 note that there is no sweep in the TRIG position of the SWEEP MODE and a normal sweep in the LINE SYNC position.

If proper sweep cannot be obtained, see Sec. 7-17 for Trouble Shooting Guides.

7-12 EXT TRIG and HOLD OFF ADJUSTMENTS

a) Set FREQUENCY SELECTOR: F1 to F2. Set SWEEP MODE to TRIG. Set all other controls as in Sec. 7-1. Connect the Tektronix 181 Time Base Generator through an attenuating network to the TRIGGER IN jack at the rear of the instrument. See Fig. 7H. Set the Tektronix 181 OUTPUT SELECTOR to 1 ms OUTPUT.

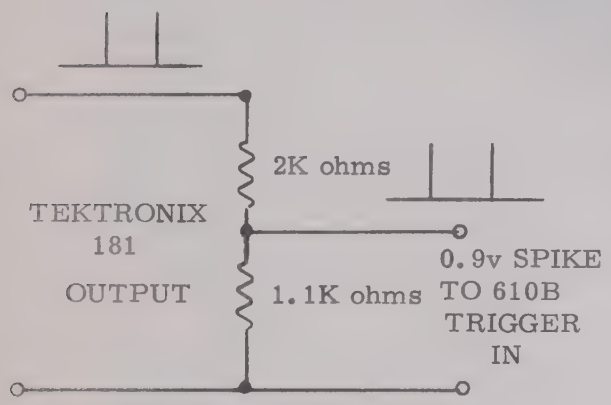


Figure 7H

ATTENUATOR NETWORK FOR EXT. TRIGGER ADJ.

b) With a 0.9v spike applied to the TRIGGER IN, a normal sweep should be observed at Pin 2 of the 610B-3A PC socket. If there is no sweep, adjust R148 EXT TRIG ADJ on the 610B-3A PC until a sweep is obtained. Set the control for the middle of its operating range.

c) With the sweep triggered externally as described in e and f, turn the SWEEP TIME selector through all of its ranges and check each range for the minimum hold-off time described in Sec. 5-3. If any range has a hold-off time less than the minimum, adjust R151 HOLD-OFF ADJ on the 610B-3A PC to bring the hold-off time up to the minimum.

If all of the hold-off times are over the minimum, bring the shortest hold-off time down to the minimum with R151.

If it is impossible to achieve any of these steps, see Sec. 7-17 for the Trouble Shooting procedure.

In some of the early 610B models, provisions for EXT TRIG ADJ and HOLD-OFF ADJ were not incorporated.

7-13 SWEEP DRIVE ADJUSTMENTS

Set the FREQUENCY SELECTOR control in the F1 to F2 position. Set all other controls as described in Section 7-1.

a) View the sweep on Pin 1 of J103 with a d.c. oscilloscope. Adjust the sweep start level with R206 - BEGIN ADJUST located on the main deck for 0V ±10mv.

b) View the sweep on the HORIZ. OUT on the front panel with a dc oscilloscope. Adjust the bottom of the ramp for 0V ±50mv with R208 HORIZ. ZERO ADJ located on PC610B-1A Rev. A.

c) Calibrate the vertical gain of the oscilloscope with reference to the +11.2V supply as described in Sec. 7-4b.

1. With the d.c. oscilloscope connected to Pin I of J103, adjust the sweep end level with R201 END ADJUST, located on the main deck, to the same level as the +11.2 V supply ±20 mv.

2. Turn SWEEP MODE to MAN. and turn the vernier until the sweep on the oscilloscope is at the +11.2 V level. Connect the .02% d.c. voltmeter to the HORIZ OUT on the front panel and adjust R209 HORIZ CAL located on the 610B-1A PC for 10 V ±50 mv on the voltmeter.

-14 MECHANICAL ADJUSTMENT OF DIAL POINTERS

a) Turn all three pointer controls CCW until they reach the end of their travel. Adjust the F1 and F2 pointers by loosening the 4-40 set screw in the top of the slide block and aligning the pointers 1/16" beyond the 0 marker of the dial. When tightening the set screw, do not apply torque as this may damage the dial cord.

b) To adjust the VAR FREQ MARKER pointer loosen the set screw in the rear of the slide block which is accessable through the 3/8" hole in the dial frame and bring pointer into alignment with F1 and F2.

c) In some of the early 610B models provisions for adjusting the pointer were not incorporated. To adjust the pointer position in one of these instruments, it is necessary to loosen the two set screws on the potentiometer dial control drum that hold the drum to the potentiometer, and turn the drum to achieve the desired alignment.

-15 FREQUENCY INSTRUCTION ADJUSTMENT

Caution: Do not perform the following calibration if the frequency instruction accuracy is acceptable.

NOTE: Mechanical Alignment of dial pointers must be correct to have proper results from these adjustments! See Sec. 7-5a for mechanical inspection of dial pointers.

a) Set FREQUENCY SELECTOR -- F1 TO F2
Set all other controls as described in Sec. 7-1.

1. Set F1 and F2 pointers exactly on 0. Connect the d.c. oscilloscope to Pin C of J103 on the rear deck of the instrument and observe the sweep waveforms. Adjust R231 TRACKING on the 610B-1A PC for a minimum amplitude of the sweep waveform. Disconnect the oscilloscope.

2. Connect the .02% d.c. voltmeter to Pin C of J 103 in place of the oscilloscope. Adjust R245 FREQ ZERO on the main deck for 0V ±5 mv on the voltmeter.

3. Set F1 and F2 pointers exactly on 0. Connect the .02% d.c. voltmeter to Pin 24 of J 401 located on the rear deck of the instrument. Adjust R354 FREQUENCY CONTROL ZERO (this is the unmarked thumb-pot on the upper side of the main deck located at the rear of the deck) for 0V ±5 mv.

4. Set F1 and F2 pointers exactly on 100%. Adjust R233 AMPLITUDE on the 610B-1A PC for 9.75 ±10mv on the voltmeter.

5. Repeat steps 2 and 3 above until the voltages stay within their tolerances.

b) Set FREQUENCY SELECTOR to CW F1 and the F1 pointer exactly on zero. With the .02% d.c. voltmeter connected to Pin 24 of J401. adjust R243 ΔF OFFSET on PC 610B-1A for 0V ±10 mv.

c) Set FREQUENCY SELECTOR to ΔF.
Set VAR FREQ MARKER to 5% of the dial scale. Turn ΔF control to 5 and observe sweep on Pin C of J103. with the d.c. oscilloscope. Adjust R225 ΔF CAL for a 500 mv ±50 mv P-P sweep waveform.

Frequency Instruction Adjustment Cont'd.

d) Repeat Recalibration Section 7-5b to insure the correct recalibration of the frequency instruction circuits. If the correct voltages and waveforms cannot be obtained, see Section 7-17 for trouble shooting suggestions.

7-16A LEVEL CONTROL ADJUSTMENT.

Set front panel controls as in Sec. 7-1.

1. With plug-in installed, connect .02% dc voltmeter to pin 19 of J401 (Located on the rear panel behind the plug-in). Adjust the RF Power Level control on the plug-in front panel for about -170mv on pin 19. Record the voltage.

2. Connect .02% dc voltmeter to pin 18 of J401 without changing the plug-in power level control, adjust R408 LEVEL BALANCE ADJ on PC 610B-4 to bring the voltage on pin 18 to within 0.2mv of the voltage recorded above in step 1.

7-16B HARMONIC MARKER GENERATOR ADJUSTMENT

Connect counter to output of harmonic marker Generator as described in Sec. 7-8.

See Fig 7-I below for location of adjustments.

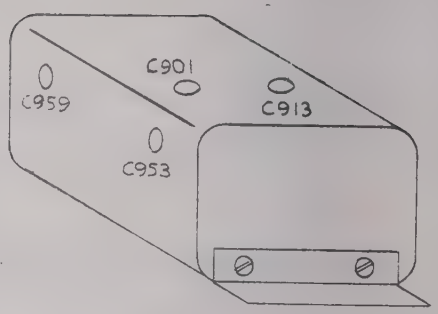


Fig 7I - 61HH adjustment locations

a) To adjust the 10MHz harmonic, adjust C913 to produce a signal 10MHz ±1kHz.

b) To adjust the 1MHz harmonic adjust C901 to produce a signal 1MHz ±100Hz.

c) To adjust the 50MHz harmonic adjust C953 to produce a signal of 50MHz ±5kH

d) To adjust the 100MHz harmonic adjust C959 to produce a signal of 100MHz ±10kHz.

e) To adjust the 61H 1 and 10 MHz Harmon Marker it is necessary to remove the front end and the cover of the unit to reach the adjustments.

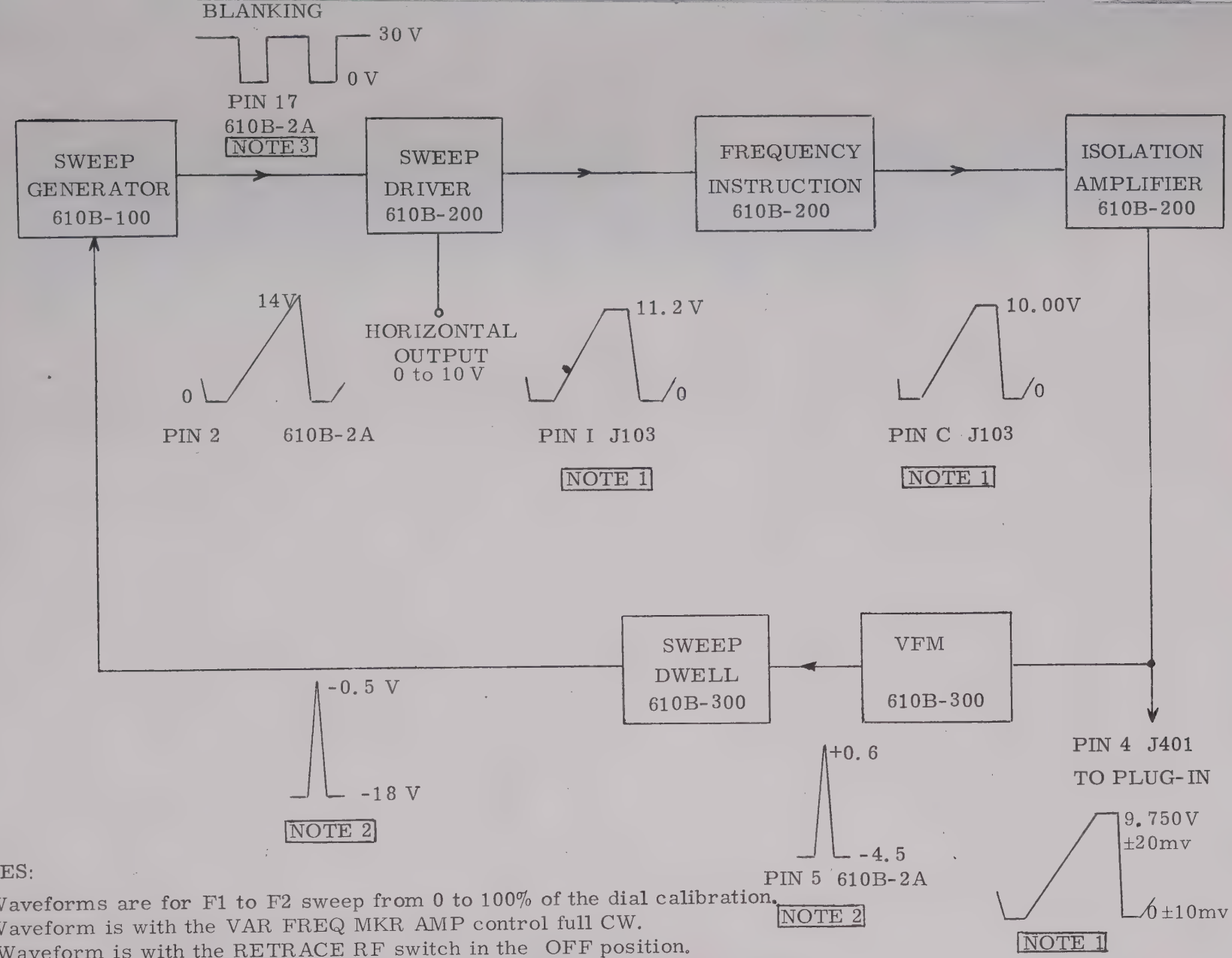


FIGURE 7-17A
SIMPLIFIED 610B SIGNAL FLOW DIAGRAM

NOTES:

1. Waveforms are for F1 to F2 sweep from 0 to 100% of the dial calibration.
2. Waveform is with the VAR FREQ MKR AMP control full CW.
3. Waveform is with the RETRACE RF switch in the OFF position.
4. Numbers inside the boxes designate drawing number for schematic diagrams of the circuits.

610B TROUBLE SHOOTING CHART

GENERAL

INDICATION	POSSIBLE CAUSE AND REMEDY
No RF OUTPUT	a) Check RETRACE RF switch. If it is in the ON position there will be no base line since the RF is on during the retrace. b) See Plug-In Trouble Shotting guide.
No Horizontal Sweep	a) Check control settings, see Section 2. b) Check for sweep at Pin 2 of 610B-3A PC socket. (See Fig. 7A) 1. If good see Sweep Driver Trouble Shooting procedure. 2. If bad see Sweep Generator Trouble Shooting Procedure.
Cannot sweep full frequency range	a) Check front panel control settings. FREQUENCY SELECTOR - F1 to F2 MODULATION - NORMAL b) Check power supply voltages as described in Section 7-2. c) Check waveform at Pin 24 of J401 on rear panel of 610B. (See Section 7-5, step 7, for description of the waveform.) 1. If the waveform is correct, see the plug-in trouble shooting procedure. 2. If the waveform is bad refer to Section 7-2 through 7-5 for Recalibration procedure.
No VARIABLE FREQUENCY MARKER indication	a) Check for proper waveform at Pin 24 J401 on rear panel (see section 7-5, step 7, for description of the waveform.) 1. If the waveform is bad refer to Section 7-2 through 7-5 for Recalibration procedure.

610B TROUBLE SHOOTING CHART

GENERAL Cont'd.

INDICATION	POSSIBLE CAUSE AND REMEDY
No VARIABLE FREQUENCY MARKER indication (continued)	2. If the waveform is good see the Trouble Shooting Chart for the VARIABLE FREQUENCY MARKER.
External RF MARKER does not operate but internal markers are o. k.	a) Turn off harmonic markers. All marker RF signals are fed into a single mixer. The 1 and 10 MHz harmonic markers beat with all other RF marker inputs. b) Use larger amplitude signal (1 V).
NARROW markers are poorly shaped but WIDE markers are o. k.	a) Reduce sweep rate to 0.1 seconds per sweep or less.
Noise on detected output.	a) Turn BIRDIE MARKER AMPLITUDE control full CCW.
No birdie markers	a) No output from Harmonic Marker Generator. (See Section 7-8 for recalibration procedure.) b) Mixer diode defective. Check diode in mixer assembly located on the 610B rear panel for a front to back resistance ratio of 100 or greater. c) Video amplifier defective. Check Q301 and Q302 on Printed card 610B-2A.
External level function does not work	a) Adjust EXT LEVEL ADJ (screwdriver adjustment on front panel) for levelled condition. b) Leveling circuit out of balance see Sec. 7-16A for adjustment procedure.

610B TROUBLE SHOOTING CHART

GENERAL Cont'd.

INDICATION	POSSIBLE CAUSE AND REMEDY
No level control, unlevelled, or light stays on	a) Turn MODULATION SWITCH to NORMAL b) See plug-in Trouble Shooting guide for level circuit trouble shooting.
Cannot externally frequency program over the whole frequency range	a) Turn FREQ CONTROL on the front panel to REMOTE b) Program circuit impedance is too low. See Section 4.
Cannot make phase lock function work	a) Check the time constants of the external phase lock control system.

POWER SUPPLY

+11.2V supply cannot be adjusted; or excessive noise on +11.2V supply.	a) CR521 is defective b) Q506 is defective c) Check +30 V supply for large AC ripp
+30V Supply cannot be adjusted. +11.2V supply is o.k.	a) Check Q502, Q503, Q504, and Q506. b) Check CR501, CR502, CR503, and CR504 for open (located on TB-1).
+30V supply high with large AC ripple and cannot be adjusted	a) Q501 or Q502 shorted. b) Check Q503 and Q506.
-20V Supply cannot be adjusted. +30V Supply is o.k.	a) CR519 is defective. b) Check Q508, Q509, Q510, Q511. c) Check CR505, CR506, CR507, and CR508 for open. (Located on TB-1).

610B TROUBLE SHOOTING CHART
POWER SUPPLY Cont'd.

INDICATION	POSSIBLE CAUSE AND REMEDY
High voltage supply at +160V	a) Check to see that plug-in is properly installed. b) Q410 shorted c) Check Q411 and Q412
High voltage supply low or inoperative	a) Check +30V supply for proper operation b) Check Q411 and Q412
Excessive ripple on all supplies	a) Make sure you are using a low frequency oscilloscope. b) Check 11.2V supply for proper operation (See Section 7-2). c) Set FREQUENCY SELECTOR to CW F1.
Noise on +30V supply, +11.2V supply o.k.	a) Set FREQUENCY SELECTOR to CW F1. b) Q503 or Q504 is noisy. c) Q506 is noisy or intermittent.
Noise on -20V supply, +11.2V and +30V supplies o.k.	a) Q509 or Q510 is noisy. b) Q511 is noisy or intermittent c) CR519 is defective.
Noise on +5.6V supply or cannot ADJ +5.6V supply (11.2V supply o.k.)	a) Q513 or Q514 or Q515 is defective.

610B TROUBLE SHOOTING CHART

SWEEP GENERATOR

INDICATION	POSSIBLE CAUSE AND REMEDY
No sweep	a) Check setting of SWEEP MODE and FREQUENCY SELECTOR controls on front panel. b) Turn CCW the amplitude control of the VAR FREQ. MKR. c) Check Pin 2 of printed circuit board 610B-3A. If there is no sweep check SWEEP BIAS ADJUST setting (See Section 7-11). d) *Check Q104 and Q107
Sweep too slow. Vernier has little or no effect on sweep speed	a) Check Q310 in PC 610B-2A. b) If the frequency determining plug-in is not installed, this will cause the problem.
Sweep time too slow/fast on all ranges	a) Check SWEEP BIAS ADJ setting. (See Section 7-11.) b) *Replace Q104.
No sweep or jumpy sweep on line sync, auto o. k.	a) Reset sweep trigger level. (See Section 7-12.)
No BLANKING OUT - Sweep o. k.	a) Check Q108.
No Base Line on Detected Output	a) Turn RETRACE RF to OFF. b) Check to see that you are getting RF output from plug-in. c) Check Q109.
Sweep stops part way through its cycle	a) Turn VARIABLE FREQ. MKR. AMPLITUDE to CCW. (If this frees the sweep, See Section 7-10 for marker amplitude adjustment.)

*Changing Q104 may require a change in R116 to achieve proper sweep times. See Section 7-4 for Recalibration procedure.

610B TROUBLE SHOOTING CHART

SWEEP DRIVE

INDICATION	POSSIBLE CAUSE AND REMEDY
END ADJUST cannot bring sweep drive output up to +11.2V supply level	a) Check output of Sweep Generator on Pin 2 610B-3A for proper sweep waveform and amplitude. (See Figure 7A.) b) Check power supply voltages. (See Section 7-2.)

FREQUENCY INSTRUCTION

Cannot adjust FREQUENCY ZERO for 0V on Pin C of J103	a) Check setting of front panel controls and frequency control pointers. (See Section 7-5.) b) Check Q203 differential amplifier on PC 610B-1A for unbalanced inputs using .02% d.c. voltmeter.
No sweep waveform on Pin 24 J401 but Sweep WF is o.k. on Pin C J103	a) Check for Jumper between Pins B and C on J103. b) Check ISOLATION AMPLIFIER for proper operation. c) Check input circuit of plug-in for short circuit.

610B TROUBLE SHOOTING CHART

VARIABLE FREQUENCY MARKER

INDICATION	POSSIBLE CAUSE AND REMEDY
Cannot recalibrate Variable Frequency marker	a) Check Q306 and Q307 for balanced operation. b) CR305 or CR306 defective. c) Q305 defective.
No intensity but Video marker o. k.	a) Q310 defective. b) Dwell adjust out of tolerance. (See Section 7-10.)
No RF marker but Video and intensity markers o. k.	a) Check MAX AMP ADJ setting, See Section 7-10.

REQUIRED TEST EQUIPMENT

INSTRUMENT	REQUIRED CHARACTERISTICS	RECOMMENDED INSTRUMENT
DC Voltmeter	a) .02% Accuracy b) Input impedance greater than 5 megaohms c) Resolution of 1mv or greater d) Center scale zero	JOHN FLUKE Model 871
DC Oscilloscope	a) 300 KC Bandwidth and horizontal amplifiers, internal sweep b) Vertical sensitivity of 1 mv/cm for AC and DC inputs c) Horizontal input for external sweep signal	TEKTRONIX Model 503
V O M (Volt-ohm-meter	a) 20,000 ohm/V DC	SIMPSON Model 270
PULSE GENERATOR	a) 1 kHz pulse rate with 10ms or less period	TEKTRONIX 181 TIME MARK GENERATOR
CRYSTAL DETECTOR	a) Flat Response (±1 db 100 kHz to 4 GHz) b) Good RF bypassing 100 kHz to 4 GHz	WILTRON Model 61DN
PLUG-IN EXTENDER CABLE	a) 3 FT. LENGTH b) Shielded cables for small signals	WILTRON Model 610B-TI
ELECTRONIC COUNTER	a) 50 ohm input. b) 100kHz to 2GHz range	HP5246L

REQUIRED TEST EQUIPMENT Cont'd.

INSTRUMENT	REQUIRED CHARACTERISTICS	RECOMMENDED INSTRUMENT
RF POWER METER	a) CALIBRATED in dbm b) ±.5 dbm accuracy or better c) 50 ohms input impedance d) Maximum power reading 0 dbm or greater e) Frequency range from 10 MHz to 400 MHz	-hp- 431C POWER METER
RF SIGNAL GENERATOR	a) Frequency range of 10 MHz to 400 MHz b) Calibrated power output in dbm. c) Signal attenuation of 40 db or greater	MEASUREMENTS Model 80

Resistors

01	10K	1/4W	5%	Fixed	Comp
02	1.2K	1/4W	5%	Fixed	Comp
03	10K	1/4W	5%	Fixed	Comp
04	9.1K	1/4W	5%	Fixed	Comp
05	6.8K	1/4W	5%	Fixed	Comp
06	910	1/4W	5%	Fixed	Comp
07	10K	1/4W	5%	Fixed	Comp
08	27K	1/4W	5%	Fixed	Comp
09	10K	1/4W	5%	Fixed	Comp
10	100K	1/4W	5%	Fixed	Comp
11	56K	1/4W	5%	Fixed	Comp
12	13K	1/4W	5%	Fixed	Comp
13	43K	1/4W	5%	Fixed	Comp
14	5.6K	1/4W	5%	Fixed	Comp
15	27K	1/4W	5%	Fixed	Comp
16	360K	Factory selected value			
17	36K	1/4W	5%	Fixed	Comp
18	2K	1/4W	5%	Fixed	Comp
19	36K	1/4W	5%	Fixed	Comp
20	5.6K	1/4W	5%	Fixed	Comp
21	1.5K	1/2W	10%	Fixed	Comp
22	3.3K	1/4W	5%	Fixed	Comp
23	10K	1/4W	5%	Fixed	Comp
24	470K	1/4W	5%	Fixed	Comp
25	4.7K	1/4W	5%	Fixed	Comp
26	10K	141-10K		Var	Comp
27	5K	141-5K		Var	Comp
28	4.7K	1/4W	5%	Fixed	Comp
29	47K	1/4W	5%	Fixed	Comp
30	7.5K	1/4W	5%	Fixed	Comp
31	5K	141-5K		Var	Comp
32	4.7K	1/4W	5%	Fixed	Comp
33	7.5K	1/4W	5%	Fixed	Comp
34	100K part of 410-47(S102)			Var	Comp
35	6.8K	1/4W	5%	Fixed	Comp
36	8.2M	1/4W	5%	Fixed	Comp
37	150K	1/4W	5%	Fixed	Comp
38	10K	142-10K		Var	Comp
39	10K	1/2W	10%	Fixed	Comp
40	18K	1/2W	10%	Fixed	Comp
41	4.7K	1W	10%	Fixed	Comp
42	36K	1/4W	5%	Fixed	Comp
43	39K	1/4W	5%	Fixed	Comp
44	50K	142-50K(Mod)		Var	Comp
45	27K	1/4W	5%	Fixed	Comp

Resistors

R146	180	1W	10%	Fixed	Comp
R147	56K	1/4W	5%	Fixed	Comp
R148	10K	141-10K		Var	Comp
R149	27K	1/4W	5%	Fixed	Comp
R150	10K	1/4W	5%	Fixed	Comp
R151	10K	141-10K		Var	Comp
R152	10K	1/4W	5%	Fixed	Comp
R201	50K	142-50K		Var	Comp
R202	220	1/4W	5%	Fixed	Comp
R203	10K	1/4W	5%	Fixed	Comp
R204	820	1/4W	5%	Fixed	Comp
R205	22K	1/4W	5%	Fixed	Comp
R206	100K	142-100K		Var	Comp
R207	15K	1/4W	5%	Fixed	Comp
R208	50K	141-50K		Var	Comp
R209	8.2K	1/4W	5%	Fixed	Comp
R210	1M	1/4W	5%	Fixed	Comp
R211	2.4K	1/2W	5%	Fixed	Comp
R212	27K	1/4W	5%	Fixed	Comp
R213	100K	1/4W	5%	Fixed	Comp
R214	180K	1/4W	5%	Fixed	Comp
R215	10K	141-10K		Var	Comp
R216	7.5K	1/4W	5%	Fixed	Comp
R217	470K	1/4W	5%	Fixed	Comp
R218	3.3K	1/4W	5%	Fixed	Comp
R219	1.1K	1/4W	1%	Fixed	Film
R220	2K	1/4W	1%	Fixed	Film
R221	Wiltron no 150-2K 10 turn			Var	WW
R222	Wiltron no.150-2K 10 turn			Var	WW
R223	Wiltron no.150-2K 10 turn			Var	WW
R224	39K	1/4W	5%	Fixed	Comp
R225	5K	143-5K		Var	Comp
R226	50K	142-50K		Var	Comp
R227	124K	1/2W	1%	Fixed	Film
R228	82.5K	1/2W	1%	Fixed	Film
R229	187K	1/4W	1%	Fixed	Film
R230	82.5K	1/2W	1%	Fixed	Film
R231	10K	153-10K		Var	WW

Resistors

R232	105K	1/2W 1%	Fixed	Film
R233	5K	151-5K	Var	Film
R234	27.4K	1/2W 1%	Fixed	Film
R235	82.5K	1/2W 1%	Fixed	Film
R236	187K	1/4W 1%	Fixed	Film
R237	113K	1/2W 1%	Fixed	Film
R238	37.4K	1/2W 1%	Fixed	Film
R239	8.25K	1/2W 1%	Fixed	Film
R240	37.4K	1/2W 1%	Fixed	Film
R241	37.4K	1/2W 1%	Fixed	Film
R242	27.4K	1/2W 1%	Fixed	Film
R243	10K	153-10K	Var	WW
R244	1M	1/2W 1%	Fixed	Film
R245	1M	142-1M	Var	Comp
R246	47	1/2W 10%	Fixed	Comp
R247	1K	1/4W 5%	Fixed	Comp
R248	330K	Factory selected value		
R249	5K	141-5K	Var	Comp
R250	7.5K	1/4W 5%	Fixed	Comp
R251	2.4K	1/4W 5%	Fixed	Comp
R252	100	1/4W 5%	Fixed	Comp
R253	1K	1/4W 5%	Fixed	Comp
R254	39K	1/4W 5%	Fixed	Comp
R255	10K	1/4W 5%	Fixed	Comp
R256	150K	1/4W 5%	Fixed	Comp
R257	22K	1/4W 5%	Fixed	Comp
R301	100K	1/4W 5%	Fixed	Comp
R302	15K	1/4W 5%	Fixed	Comp
R303	2.2K	1/4W 5%	Fixed	Comp
R304	100K	1/4W 5%	Fixed	Comp
R305	20K	1/4W 5%	Fixed	Comp
R306	6.8K	1/4W 5%	Fixed	Comp
R307	1K	1/4W 5%	Fixed	Comp
R308	1.5K	1/4W 5%	Fixed	Comp
R309	100	1/4W 5%	Fixed	Comp
R310	2K	1/4W 5%	Fixed	Comp
R311	100K	Part of 410-47(S311)	Var	Comp
R312	47K	1/4W 5%	Fixed	Comp
R314	180K	1/4W 5%	Fixed	Comp
R315	47K	1/4W 5%	Fixed	Comp
R316	82.5K	1/2W 1%	Fixed	Film
R317	10K	153-10K	Var	WW
R318	174K	1/2W 1%	Fixed	Film
R320	300K	1/4W 5%	Fixed	Comp

Resistors

R321	300K	1/4W 5%	Fixed	Comp
R322	10K	153-10K	Var	WW
R322A	10K	1/4W 5%	Fixed	Comp
R323	200K	1/4W 5%	Fixed	Comp
R324	62K	1/4W 5%	Fixed	Comp
R325	12K	1/4W 5%	Fixed	Comp
R326	10K	141-10K	Var	Comp
R327	100K	Part of 410-47(S327)	Var	Comp
R328	20K	1/4W 5%	Fixed	Comp
R329	20K	1/4W 5%	Fixed	Comp
R330	390K	1/4W 5%	Fixed	Comp
R331	10K	1/4W 5%	Fixed	Comp
R332	47K	1/4W 5%	Fixed	Comp
R333	39K	1/4W 5%	Fixed	Comp
R334	12K	1/4W 5%	Fixed	Comp
R335	56K	1/4W 5%	Fixed	Comp
R336	2.2K	1/4W 5%	Fixed	Comp
R337	10K	1/4W 5%	Fixed	Comp
R338	20K	1/4W 5%	Fixed	Comp
R339	470K	1/4W 5%	Fixed	Comp
R340	24K	1/4W 5%	Fixed	Comp
R341	10K	141-10K	Var	Comp
R342	20K	1/4W 5%	Fixed	Comp
R343	82K	1/4W 5%	Fixed	Comp
R344	4.7K	1/4W 5%	Fixed	Comp
R345				
R346				
R347	10K	1/4W 5%	Fixed	Comp
R348				
R349	82K	1/4W 5%	Fixed	Comp
R350	100K	1/4W 5%	Fixed	Comp
R351	47K	1/4W 5%	Fixed	Comp
R352				
R353				
R354	15K	1/4W 5%	Fixed	Comp
R401	10K	1/4W 5%	Fixed	Comp
R402	50K	142-50K	Var	Comp
R403	1.5K	1/4W 5%	Fixed	Comp
R404	1K	1/4W 5%	Fixed	Comp
R405	10K	1/4W 5%	Fixed	Comp
R406	100K	1/4W 5%	Fixed	Comp
R407	150K	1/4W 5%	Fixed	Comp
R408	1K	141-1K	Var	Comp
R409	270K	1/4W 5%	Fixed	Comp
R410	15K	1/4W 5%	Fixed	Comp

Resistors

1	1K	1/4W	5%	Fixed	Comp
2	33K	1/4W	5%	Fixed	Comp
3	330	1/4W	5%	Fixed	Comp
4	68K	1/4W	5%	Fixed	Comp
5	36K	1/4W	5%	Fixed	Comp
6	5.1K	1/4W	5%	Fixed	Comp
7	15K	1/4W	5%	Fixed	Comp
8	10K	1/4W	5%	Fixed	Comp
9	1K	1/4W	5%	Fixed	Comp
0	120K	1/4W	5%	Fixed	Comp
1	100K	1/4W	5%	Fixed	Comp
2	270K	1/4W	5%	Fixed	Comp
3	2.2K	1/4W	5%	Fixed	Comp
4	9.1K	1/4W	5%	Fixed	Comp
5	56K	1/4W	5%	Fixed	Comp
6	9.1K	1/4W	5%	Fixed	Comp
7	1M	142-1M		Var	Comp
8	10K	1/4W	5%	Fixed	Comp
9	2K	1/4W	5%	Fixed	Comp
0	160K	1/4W	5%	Fixed	Comp
1	9.1K	1/4W	5%	Fixed	Comp
2	130K	1/4W	5%	Fixed	Comp
3	15K	1/4W	5%	Fixed	Comp
4	5.1K	1/4W	5%	Fixed	Comp
5	15	1/4W	5%	Fixed	Comp
6	47K	1/4W	5%	Fixed	Comp
7	47K	1/4W	5%	Fixed	Comp
8	47	1/4W	5%	Fixed	Comp
9	1.5K	1/4W	5%	Fixed	Comp
0	120K	1/4W	5%	Fixed	Comp
1	200K	1/4W	5%	Fixed	Comp
2	15K	1/4W	5%	Fixed	Comp
3	110K	1/4W	5%	Fixed	Comp
4	30K	1/4W	5%	Fixed	Comp
5	62K	1/4W	5%	Fixed	Comp
6	39K	1/4W	5%	Fixed	Comp
7	6.8K	1/4W	5%	Fixed	Comp
8	68K	1/4W	5%	Fixed	Comp
9	68K	1/4W	5%	Fixed	Comp
0	330K	1/4W	5%	Fixed	Comp
1	120K	1/2W	10%	Fixed	Comp
2	22K	1/4W	5%	Fixed	Comp
3	6.2K	1/4W	5%	Fixed	Comp
4	1K	1/2W	1%	Fixed	Metal film
5	91K	1/4W	5%	Fixed	Comp
6	680	1/4W	5%	Fixed	Comp

Resistors

R457	47K	1/4W	5%	Fixed	Comp
R458	1K	1/4W	5%	Fixed	Comp
R501	47K	1/4W	5%	Fixed	Comp
R502	1 ohm	3W	5%	Fixed	WW
R503	1 ohm	3W	5%	Fixed	WW
R504	1K	1/4W	5%	Fixed	Comp
R505	3K	1/2W	5%	Fixed	Comp
R506	27K	1/4W	5%	Fixed	Comp
R507	27K	1/4W	5%	Fixed	Comp
R508	15K	1/4W	5%	Fixed	Comp
R509	3.9K	1/4W	5%	Fixed	Comp
R510	3.74K	1/8W	1%	Fixed	Film
R511	27.4K	1/4W	1%	Fixed	Film
R512	50K	141-50K		Var	Comp
R513	2.21K	1/8W	1%	Fixed	Film
R514	36	Factory selected value			
R515	11K	1/4W	5%	Fixed	Comp
R516	1.5K	1/4W	5%	Fixed	Comp
R517	1 ohm	3W	5%	Fixed	WW
R518	1 ohm	3W	5%	Fixed	WW
R519	1.5K	1/4W	5%	Fixed	Comp
R520	8.2K	1/4W	5%	Fixed	Comp
R521	30K	1/4W	5%	Fixed	Comp
R522	56K	1/4W	5%	Fixed	Comp
R523	15K	1/4W	5%	Fixed	Comp
R524	50K	141-50K		Var	Comp
R525	9.09K	1/8W	1%	Fixed	Film
R526	22.1K	1/4W	1%	Fixed	Film
R527	3.4K	1/8W	1%	Fixed	Film
R528	1K	1/4W	5%	Fixed	Comp
R529	100	Factory selected value			
R530	13K	1/4W	5%	Fixed	Comp
R531	2K	1/4W	5%	Fixed	Comp
R532	1.5K	1/4W	5%	Fixed	Comp
R533	10K	1/2W	10%	Fixed	Comp
R534	10K	1/2W	10%	Fixed	Comp
R535	3K	1/4W	5%	Fixed	Comp
R536	50K	141-50K		Var	Comp
R537	4.42K	1/4W	1%	Fixed	Film
R538	510	1/4W	5%	Fixed	Comp
R539	1K	1/4W	1%	Fixed	WW
R540	1.24K	1/4W	1%	Fixed	WW

Resistors

R541	1.5K	1/4W	5%	Fixed Comp
R542	2K	1/4W	5%	Fixed Comp
R543	400	3W	5%	WW
R544	5.62K	1/8W	1%	Fixed Film
R545	500	141-500		Var Comp
R546	5.62K	1/8W	1%	Fixed Film
R547	1.5K	1/4W	5%	Fixed Comp
R548	2.4K	1/4W	5%	Fixed Comp
R549	510	1/4W	5%	Fixed Comp
R550	2.7K	1/4W	5%	Fixed Comp
R551	11K	1/8W	1%	Fixed Film
R552	2K	1/8W	1%	Fixed Film
R553	9.09K	1/8W	1%	Fixed Film
R554	1.2K	1/4W	5%	Fixed Comp
R555	1K	1/2W	5%	Fixed Comp

Capacitors

C101	.1μf	200V	20%	Fixed Mylar
C102	5pf	500V	5%	Fixed Mica
C103	.001μf	1KV	10%	Fixed Ceram
C104	.001μf	1KV	10%	Fixed Ceram
C105	68pf	500V	5%	Fixed Mica
C106	.001μf	1KV	10%	Fixed Ceram
C107A	1μf	250V	10%	Fixed met poly
C107B	1μf	250V	10%	Fixed met poly
C108A	.1μf	250V	10%	Fixed met poly
C108B	.1μf	250V	10%	Fixed met poly
C109	.02μf	200V	5%	Fixed Mylar
C110	.002μf	125V	5%	Fixed Poly
C111	50μf	25V		Fixed Lytic
C112	5μf	50V		Fixed Lytic
C113	.47μf	250V	20%	Fixed Mylar
C114	.047μf	250V	10%	Fixed Mylar
C115	.02	500V	20%	Fixed Ceram
C116	7pf	500V	5%	Fixed Mica
C117	7pf	500V	5%	Fixed Mica
C118	51pf	500V	5%	Fixed Mica
C119	7pf	500V	5%	Fixed Mica
C201	.001μf	1KV	10%	Fixed Ceram
C202	.02μf	500V	20%	Fixed Ceram
C203	.001μf	1KV	10%	Fixed Ceram

Capacitors

C301	.001μf	1KV	10%	Fixed Ceram
C302	.01μf	500V	20%	Fixed Ceram
C303	.05μf	100V	+80-20%	Fixed Ceram
C304	2000pf	250V	5%	Fixed Poly
C305	32μf	64V		Fixed Lytic
C306	.01μf	500V	20%	Fixed Ceram
C307	32μf	64V		Fixed Elect
C308	.01μf	500V	20%	Fixed Ceram
C309	32pf	64V		Fixed Lytic
C311	270pf	500V	5%	Fixed Mica
C312	47pf	500V	5%	Fixed Mica
C313	270pf	500V	5%	Fixed Mica
C314	.01μf	500V	20%	Fixed Ceram
C401	6.8μf	35V		Fixed Lytic
C402	6.8μf	35V		Fixed Lytic
C403	1μf	200V	20%	Fixed Mylar
C404	.1μf	250V	20%	Fixed Mylar
C405	47pf	500V	5%	Fixed Mica
C406	.001μf	1KV	10%	Fixed Ceram
C407	.0047μf	500V	20%	Fixed Ceram
C408	.001μf	1KV	10%	Fixed Ceram
C409	.033μf	100V	10%	Fixed Mylar
C410	.033μf	100V	10%	Fixed Mylar
C411A	80μf	150V		Fixed Lytic
C411B	50μf	150V	250-21	Fixed Lytic
C412	.1μf	250V	20%	Fixed Mylar
C413	.001μf	1KV	10%	Fixed Ceram
C414	220pf	500V	5%	Fixed Mica
C415	4.7μf	10V		Fixed Lytic
C501	.01μf	500V	20%	Fixed Ceram
C502	.01μf	500V	20%	Fixed Ceram
C503	1000μf	50V	250-15	Fixed Lytic
C505	6.8μf	35V	10%	Fixed Tant
C506	1000μf	50V	250-15	Fixed Lytic

Capacitors

C508	.1μf	200V	10%	Fixed Mylar
C509	6.8μf	35V	10%	Fixed Tant
C510	.1μf	200V	10%	Fixed Mylar
C511	.1μf	200V	10%	Fixed Mylar
C512	.1μf	200V	10%	Fixed Mylar
C513	.01μf	500V	20%	Fixed Ceram
C514	10μf	64V		Fixed Lytic
C515	.047μf	200V	10%	Fixed Mylar
C516	200pf	500V	5%	Fixed Mica
C517	32μf	64V		Fixed Lytic
C518	10μf	64V		Fixed Lytic
C519	10μf	64V		Fixed Lytic
C520	32μf	64V		Fixed Lytic
C521	.1μf	200V	10%	Fixed Mylar

Transformer

T501 Power WILTRON No. 320-17A

Inductors

L301 50mh 310-4
L302 1.17mh 310-6

Transistors

Q101A	2N3566	Q207	2N4249
Q101B	2N3566	Q208	2N3566
Q102	2N3565	Q209	2N3569
Q103	2N3565	Q210	2N4249
Q104	2N4303	Q211	2N4249
Q105	2N3565	Q301	2N3565
Q106	2N3694	Q302	2N3565
Q107	2N3565	Q303	2N3565
Q108	2N3566	Q304	2N3565
Q109	2N3566	Q305	2N4045
Q110	2N3566	Q306	2N4249
Q111	2N3644	Q307	2N4249
Q112	2N3644	Q308	2N3694
		Q309	2N3565
Q201	2N3566	Q310	2N4249
Q202	2N3569	Q401	2N4249
Q203	2N4045	Q402	2N4249
Q204	2N3565	Q403	2N3565
Q205	2N3565	Q404	2N3694
Q206	2N4249	Q405	2N4390

Transistors

Q406	2N3565	Q506	μa709
Q407	2N3565	Q507	2N3055
Q408	2N398B	Q508	2N4355
Q409	2N398B	Q509	2N3569
Q410	40313	Q510	2N3569
Q411	40354	Q511	TD100
Q412	40354	Q512	2N2218
Q413	2N4249	Q513	2N4249
Q414	2N4249	Q514	2N3565
		Q515	2N3565
Q501	2N3055	Q516	2N4249
Q502	2N4355		
Q503	2N3569		
Q504	2N3569		
Q505	TD100		

Diodes

CR101	1N458A	CR406	1N4383
CR102	1N458A	CR407	1N4446
CR103	1N458A	CR408	1N4446
CR104	1N4446	CR409	1N4446
CR105	FD300		
CR106	1N4446	CR501	1N4383
CR107	1N4446	CR502	1N4383
CR108	1N4446	CR503	1N4383
		CR504	1N4383
CR201	1N483B	CR505	1N4383
CR202	1N483B	CR506	1N4383
CR203	1N483B	CR507	1N4383
CR204	1N483B	CR508	1N4383
		CR509	1N4446
CR301		CR510	1N4446
CR303	1N4446	CR511	1N4446
CR304	1N4446	CR512	1N4749
CR305	1N4446	CR513	1N4446
		CR514	1N4446
CR306	1N4446	CR515	1N4446
CR307	1N4446	CR516	1N4446
CR309	1N4446	CR517	1N4446
C4310	1N4446	CR518	1N4446
CR401	1N4446	CR519	1N823
CR402	1N4446	CR520	1N4446
CR403	1N4446	CR521	1N823
CR404	1N4446	CR523	1N4446
CR405	1N4383		

Switches

S101	Rotary	Wiltron No. 410-33
S102	Rotary	Wiltron No. 410-47
S103	Push button	Wiltron No. 430-11
S104	Rotary	Wiltron No. 410-36
S201	Rotary	Wiltron No. 410-34
S301	Rotary	Wiltron No. 410-47
S302	Rotary	Wiltron No. 410-47
S401	Rotary	Oak No. 399430-K
S501	Push button	Wiltron No. 430-10
S502	DPDT Slide	Wiltron No. 430-9
S11	SPST	Wiltron No. 420-5
S12	SPST	Wiltron No. 420-5
S13	SPST	Wiltron No. 420-5
S14	SPST	Wiltron No. 420-5
S15	SPDT	Wiltron No. 420-6
S16	SPDT	Wiltron No. 420-6

Miscellaneous

Mixer Load Assy. 610B-S-1102
Printed Card Socket - Wiltron No. 551-7
610B-1A thru 610B-6A

DS401 WILTRON No. 632-11
DS501 Type NE2J
F501 .8 SLO BLO WILTRON No. 631-6
P501 Power Cord WILTRON No. 800-21

3 Pointed Mechanical Dial System 610B-ML
INTERNAL DETECTOR Wiltron Model 61D-
Birdie Marker Mixer Assembly -
No. 610B-MS-4

Connectors

J101	510-5
J102	510-5
J103	701-4 Barrier Terminal
J104	510-5 BNC Connector
J108	510-5
J401	520-7 Connector 510-7

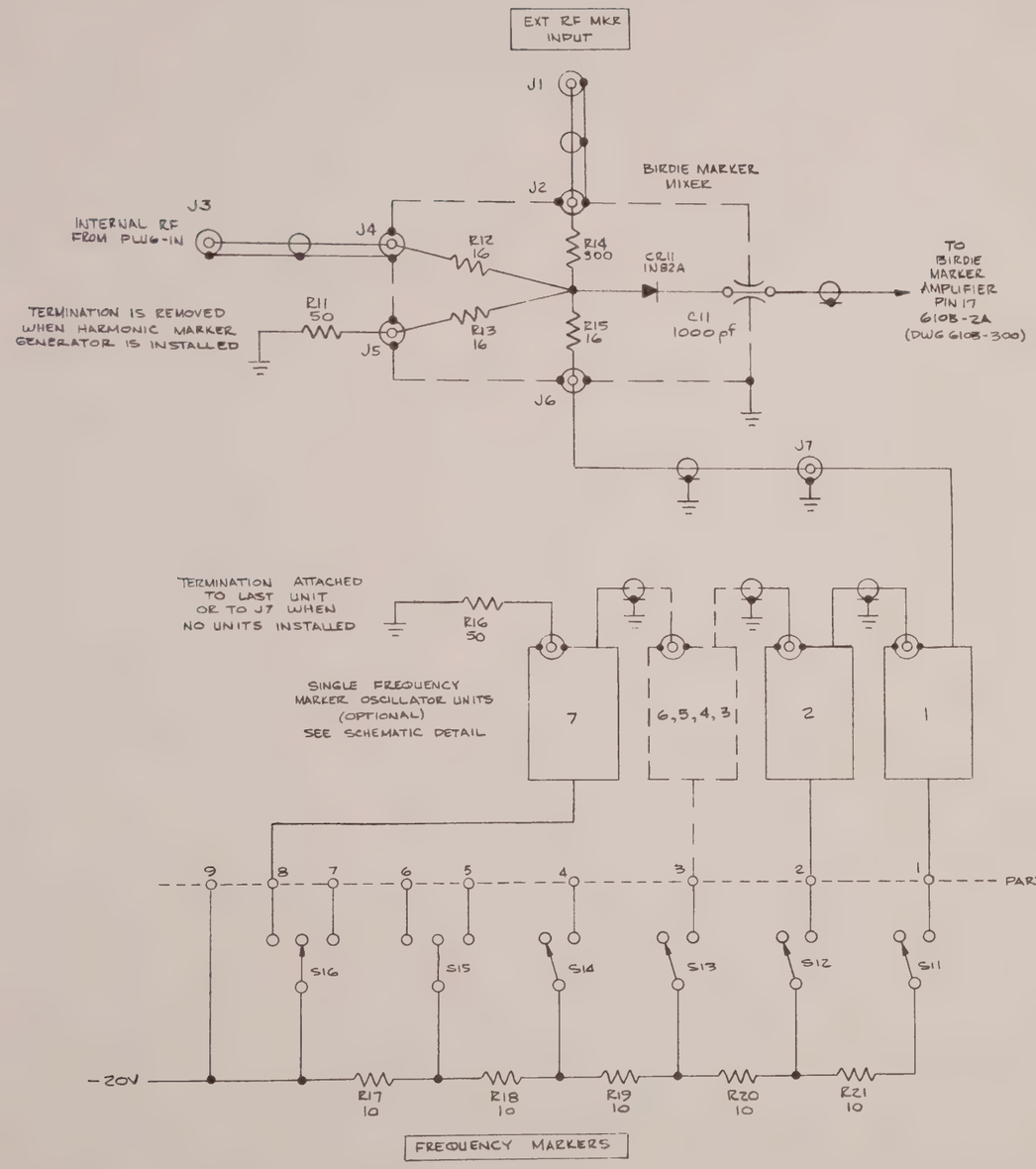
REMOTE OR SWEPT FREQUENCY PROGRAMMING

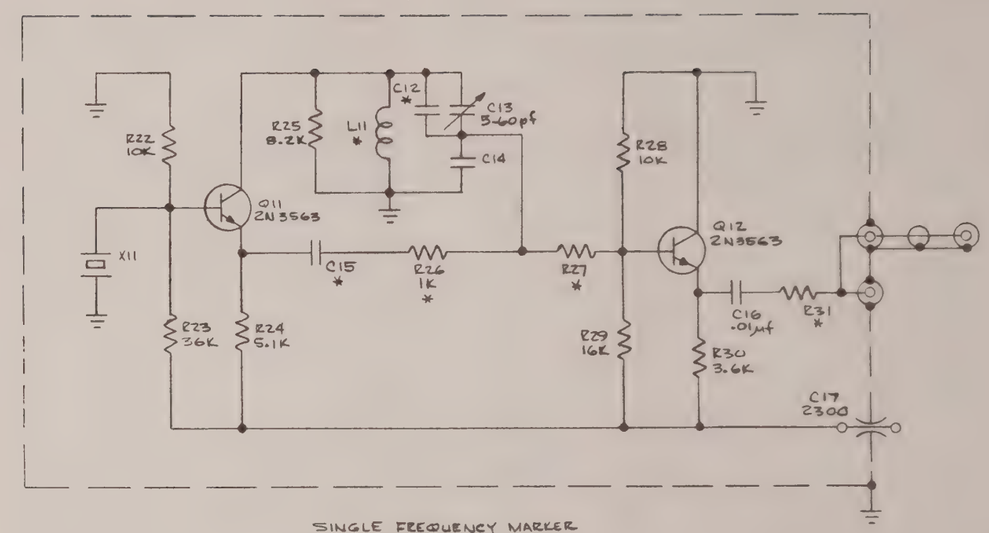
610B REAR PANEL

ΔF
50K
F_o
10K
REMOTE
10K
I H G F E D C B A
115/230V
50-400 Hz
EXTERNAL TRIGGER
BLANKING OUTPUT
SWEEP
INPUT 1
+5.6V
+11.2V
INPUT 2
OUTPUT
+10.6V
HARMONIC MARKER GENERATOR
MARKER OSC
MARKER OSC
MARKER OSC
50Ω TERM
ISOLATION AMPLIFIER
REGULATED POWER SUPPLIES
MIXER
MARKER VIDIO AMPLIFIER
VAR FREQ MARKER GENERATOR
SWEEP DWELL
RF PIP
INTENSITY
VIDEO
J401
P801
24
19
18
6
SWEEP TO PLUG-IN
LEVEL CONTROL REFERENCE
LEVEL DETECTOR OUTPUT
LEVEL REGULATOR OUTPUT
PLUG-IN UNIT
LEVEL REGULATOR AND MODULATION SELECTOR
FREQUENCY INSTRUCTIONS
SWEEP DRIVER
SWEEP GENERATOR
DETECTOR
610B FRONT PANEL
RF OUT
EXT RF MARKER
EXT INPUT
MODULATION
FREQ SELECTOR
F1
VAR FREQ MARKER
F2
RF IN
FROM EXT DET
VERT OUT
HORIZ OUT
SWEEP TIME
SWEEP MODE

610B FLOW DIAGRAM

610B FLOW DIAGRAM





SINGLE FREQUENCY MARKER

UNLESS OTHERWISE NOTED:
RESISTANCE IN OHMS
CAPACITANCE IN
INDUCTANCE IN

BIRDIE MARKERS

610B-3B

BLANKING J102

+30V PULSE DURING RETRACE

1KC BLANKING INPUT FROM PIN 12, 610B-4A (DWG 610B-400)

+30V

10 14 1 15

R146 180

R141 4.7K

R117 36K

R120 5.6K

R121 1.5K

CR107 IN4446

C118 51Pf

Q111 2N 3644

Q112 2N3644

R145 27K

C119 7Pf

C117 7Pf

Q108 2N3566

C116 7Pf

Q109 2N3566

R118 2K

R119 36K

R142 36K

Q110 2N3566

CR108 IN4446

17

BLANKING +

TO R447 (DWG 610B-400)

R335 68K

TO PIN 10 610B-2A (DWG 610B-300)

J401 PIN 3

BLANKING -

TO PIN 17, 610B-4A LEVEL REGULATOR (DWG 610B-400) AND TO R327 VAR FREQ MK RAMP (DWG 610B-300)

RETRACE RF

S104 OFF ON

13

J401 PIN 15

+30V

1

+30V

R147 56K

EXT TRIG ADJ

R148 10K

R149 27K

-20V

R122 3.3K

R123 10K

R124 470K

Q104 2N4303

Q105 2N3565

Q106 2N3694

R102 1.2K

R106 910

R113 43K

R112 13K

R114 5.6K

R115 27K

R116 360K

C103 .001

CR103 IN458A

C104 .001

Q102 2N3565

C105 68pf

R111 56K

Q103 2N3565

CR105 ED300

C106 .001

R125 4.7K

SWEEP MODE

SWEEP TRIGGER

J701

TRIGGER

S101A2

16

C101 .1

R150 10K

R103 10K

Q101A 2N3566

Q101B 2N3566

R126 10K

R129 47K

SWEEP BIAS ADJUST

-20V

MANUAL

LINE SYNC

AUTO

R101 10K

CR101 IN458A

CR102 IN458A

R107 10K

R108 27K

CR104 IN4446

+30V

R143 39K

60 Hz FROM T501 TERMINAL 5 (DWG 610B-500)

R104 9.1K

R105 6.8K

-20V

R109 10K

R110 100K

-20V

9

4 3

R127 5K

R128 4.7K

R144 50K

MANUAL SWEEP

TRIG S101 B2 FROM S201-A2 (DWG 610B-200)

MANO L.SYNC

AUTO

C107 2μf

C108 .2μf

C109 .02μf

C110 .002μf

C111 50μf

C112 5 μf

C113 .47μf

C114 .047μf

R136 8.2M

C102 5pf

S102 SWEEP TIME

J401 PIN 8

SEE 610B-300

R134 100K

SWEEP VERNIER

R135 6.8K

SWEEP START LEVEL

S101 B1

2

SWEEP TO PIN 5 610B-1A (DWG 610B-200)

R139 10K

R138 10K

TRIGGER ADJ

TRIGGER

S101-A1

6

MANUAL

LINE SYNC

AUTO

R140 18K

-20V

CR106 IN4446

Q107 2N3565

8

S103

TRIGGER

-20V

R130 7.5K

C115 .02

R137 150K *

HOLD OFF ADJ

-20V

R131 5K

R132 4.7K

SWEEP END LEVEL

R152 10K

R151 10K

-20V

R133 7.5K

18

-20V

610B-3B SWEEP GENERATOR

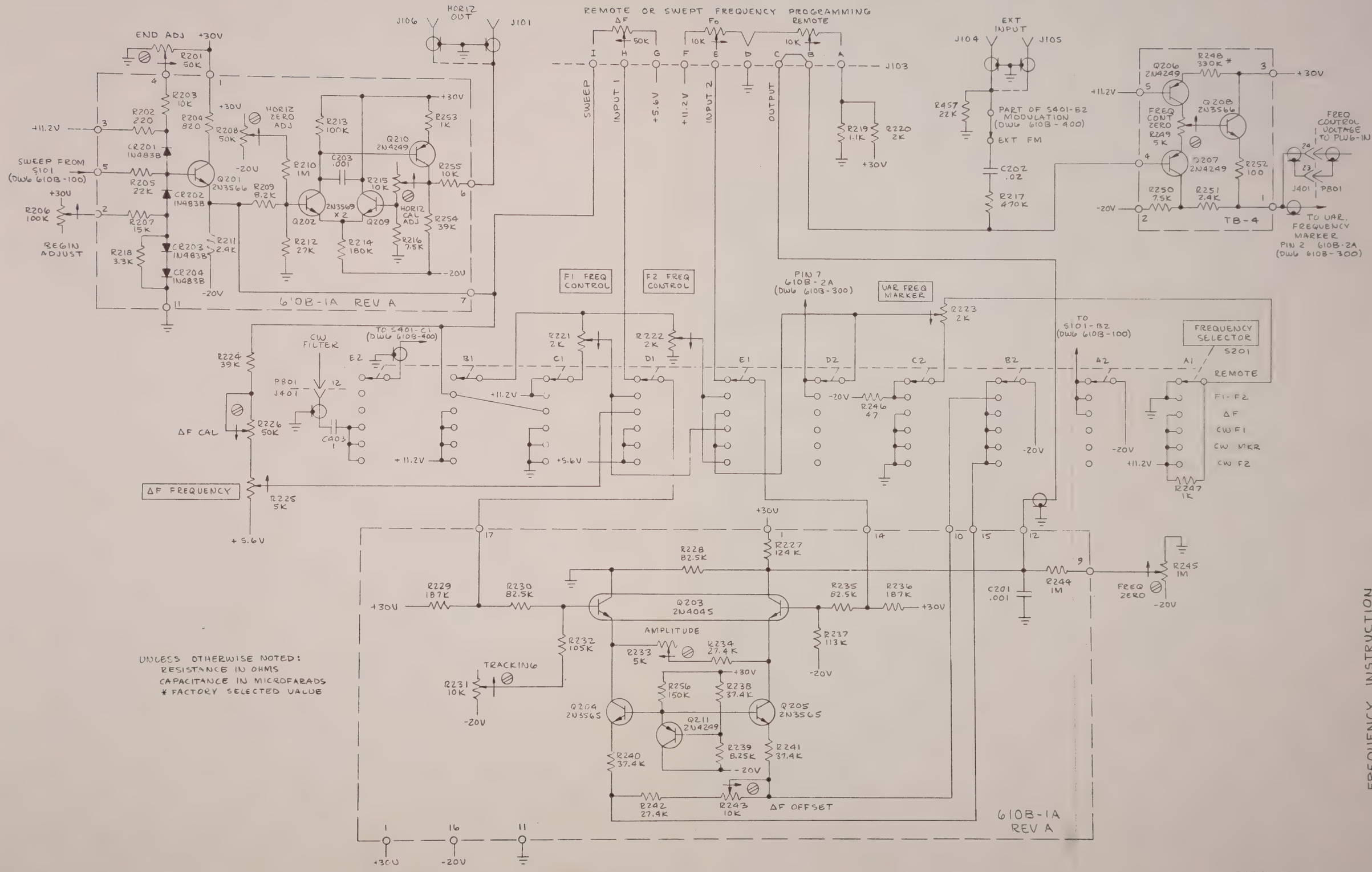
SWEEP GENERATOR

UNLESS OTHERWISE NOTED:
RESISTANCE IN OHMS
CAPACITANCE IN MICROFARADS
* FACTORY SELECTED VALUE

SWEEP GENERATOR

PRINT: 6-69

610B-100
8-7-69



FREQUENCY INSTRUCTION

PRINT: 6-69

FREQUENCY INSTRUCTION

610B-200
2-13-69

610B-2A
REV A

NARROW
WIDE
S301
BIRDIE MARKERS
C305 32
+30V
15
16
3
1
R307 1K
R306 6.8K
R304 100K
R305 20K
R309 100
R310 2K
C309 32
C308 .01
14
Q302 2N3565
R301 100K
L301 50mh
C303 .05
R308 1.5K
L302 1.17mh
C304 2000pf
R354 15K
C306 .01
Q301 2N3565
C302 .01
C301 .001
R302 15K
R303 2.2K
C307 32
FROM BIRDIE MARKER MIXER C111 (DWG 610B-001)
17

INTERNAL DETECTOR
RF IN
R315 47K
R314 180K
R351 47K
J108
VERT OUT
J107
J109 FROM EXTERNAL DETECTOR
BIRDIE MARKER AMPLITUDE
R311 100K
13
C313 270pf
R312 47K
C311 270pf
12
Q303 2N3565
Q304 2N3565
R349 82K
R332 47K
R333 39K
R334 12K
R350 100K
C315 .01
-20V
9
10
R335 56K
C314 .01
R336 2.2K
BLANKING OUT FROM PIN 10 610B-3B (DWG 610B-100)

MAX AMPL ADJ
+30V
R320 300K
R321 300K
R325 12K
R326 10K
R345 100K
-5.6V PIN 8
6
R327 100K
BLANKING PIN 17 610B-3B
VAR FREQ MKR AMP
Q306 2N4249
Q307 2N4249
CR309 IN4446
CR310 IN4446
R330 390K
Q308 2N3694
CR305 IN4446
CR306 IN4446
R328 20K
R329 20K
R331 10K
-20V
5
RF PIP
S302
VIDEO
INTENSITY
VAR FREQ MARKER
CR307 IN4446
J401
P801
TO POWER LEVEL CONTROL IN PLUG-IN
16

FROM PIN 1 TB4 (DWG 610B-200)
2
-20V
R246 47
S201 C2
DWG 610B-200
S201 D2
R223 2K
S201 A1
VAR FREQ MARKER
7
R316 82.5K
CALIBRATE
R317 10K
R318 174K
Q305 2N4045
CR303 IN4446
CR304 IN4446
* R322A
R322 10K
BALANCE
R323 200K
C312 47pf
R324 62K
SWEEP VERNIER DWG 610B-100
R135 6.8K
R134 100K
8
20
R339 470K
Q310 2N4249
Q309 2N3565
R337 10K
R338 20K
R340 24K
R342 20K
R343 82K
R344 4.7K
R341 10K
DWELL ADJUST
-20V
4
610B-2A
REV A
11
18
-20V
8
-5.6V
5
R347 10K
VARIABLE MARKER OUT J110 (OPTION)

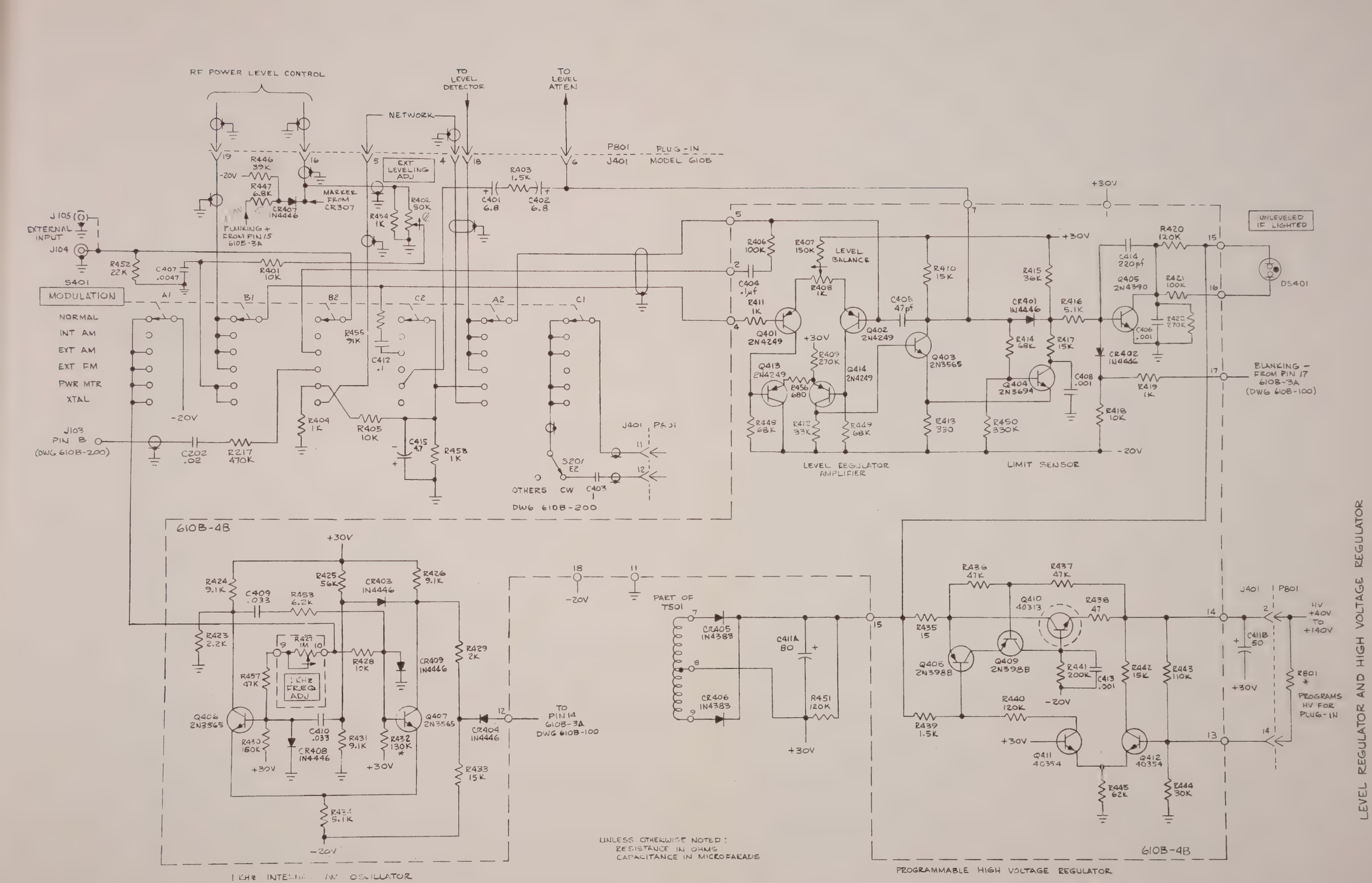
UNLESS OTHERWISE NOTED:
RESISTANCE IN OHMS
CAPACITANCE IN MICROFARADS
INDUCTANCE IN MILLIHENRIES

VARIABLE AND BIRDIE MARKERS

VARIABLE AND BIRDIE MARKERS

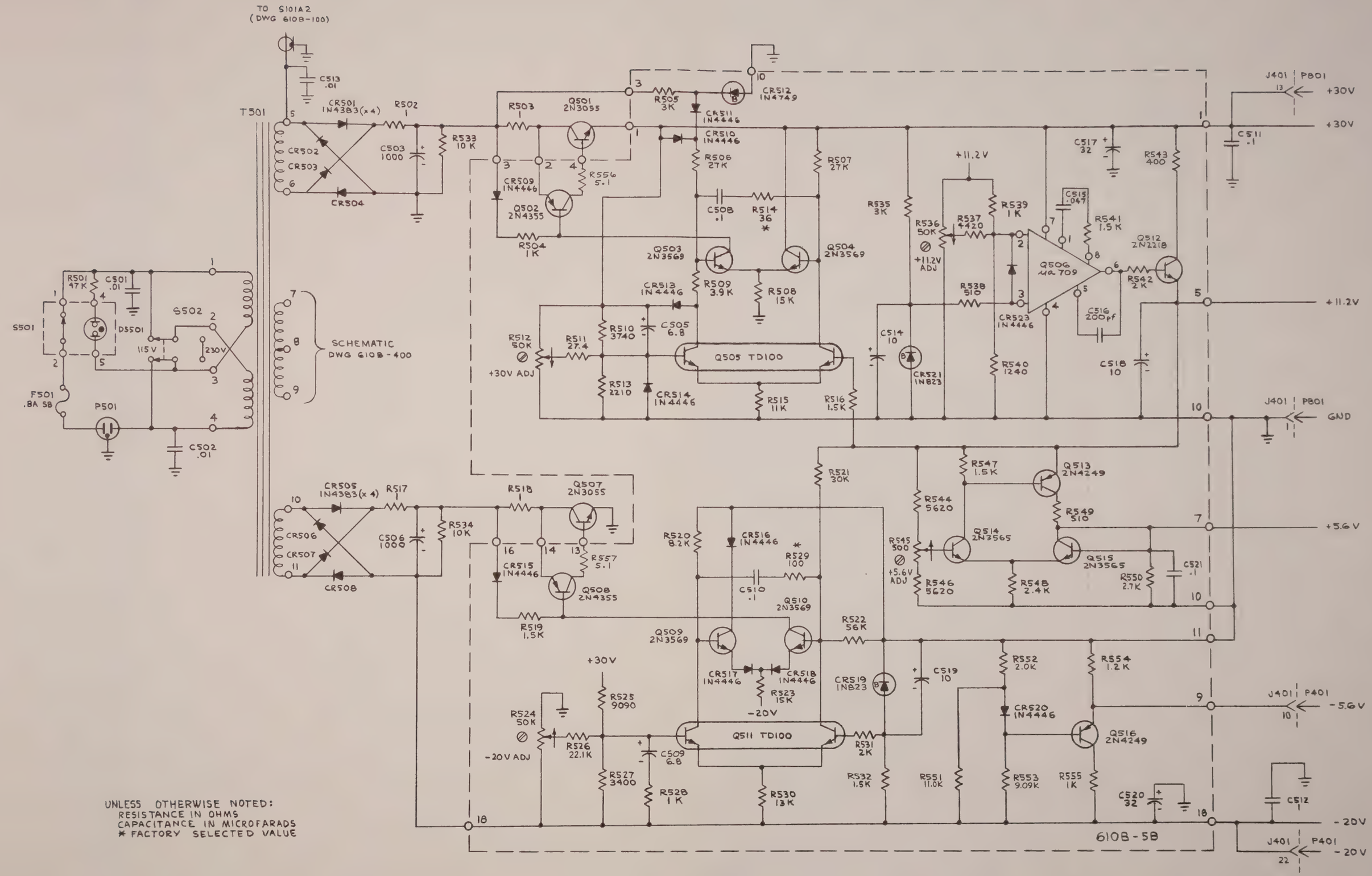
PRINT: 6-69

610B-300
4-14-69



PRINT: 6-69

610B-400
E-17-68



UNLESS OTHERWISE NOTED:
RESISTANCE IN OHMS
CAPACITANCE IN MICROFARADS
* FACTORY SELECTED VALUE

MODEL 6104

PLUG-IN (100 kHz - 100 MHz)

INSTRUCTION MANUAL

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(Also see 610B MANUAL)

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1-4 FREQUENCY CONTROL

RECALIBRATION PROCEDURE — SECTION 2

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2-2 R. F. AMPLIFIER GAIN TEST
2-3 MULTIPLIER MIXER and LEVEL CONTROL RECALIBRATION
2-4 FREQUENCY ZERO RECALIBRATION
2-5 ADJUSTMENTS
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PARTS LIST — SECTION 3

SCHEMATICS and FLOW DIAGRAM — SECTION 4

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SECTION 1

MODEL 6104 PLUG - IN
THEORY OF OPERATION

1-1 GENERAL

The Model 6104 covers the R. F. band of 100 kHz to 100 MHz using a heterodyne technique. See the 6104 Flow Diagram. A fixed frequency of 400 MHz is mixed with a variable 400 to 500 MHz swept frequency to generate the desired R. F. This signal is increased to 2v rms in the power amplifier where the level detector is located. Level control is applied to the 400 MHz signal and a leveled 1v rms is delivered to the 50 ohm output. Refer also to the Theory of Operation of the Model 610B Main Frame.

1-2 R. F. FREQUENCY GENERATOR

The 400 MHz fixed frequency is derived from a multiplier chain consisting of Q601 50 MHz crystal oscillator, Q602 x2 multiplier and buffer and Q603 x4 multiplier. See schematic 6104-600. A resistance coupled four section filter delivers a pure 400 MHz signal to the balanced mixer CR-602 and CR603. The bias current of the x4 multiplier is varied to achieve level control.

The swept oscillator, Q625, has voltage applied through R626 to the varactor diode, CR625, which tunes L625 to generate 400 to 500 MHz. The amplifiers Q625, 626 and 627 isolate the oscillator from the output and raise the signal level. The swept oscillator output is applied through the balun, L613 and L612 to give balanced drive to the mixer. The configuration of the mixer produces low distortion and spurious frequency levels. The desired output is coupled through Q604 to a 50 ohm output line and then to the power amplifier.

1-3 POWER AMPLIFIER

The input signal passes through a 120 MHz low pass filter to drive through stages of common emitter gain, Q701, 2 and 3. Two emitter followers, Q703 and 4 provide power gain to deliver 2 volts rms to R726. This is attenuated to the emitter follower, Q706, and coupled through a rear connector to the birdie mixer. This same signal is sampled through R723, see schematic 6104-700, to the doubling detector CR701, CR702. The R. F. Power Level Venier attenuates the detector output to the 610B level regulator to produce a nominal 3db increase in the output R. F. The level loop is completed through the x4 multiplier which functions as a voltage controlled attenuator.

The action of the level loop is to maintain the voltage constant at the output of Q708 regardless of load variations; hence, a zero impedance source is created. A 50 ohm resistor, R726, is added in series to give a 50 ohm source impedance and reduces the output to 1 volt rms. The R. F. passes through a 10db step attenuator to the output jack. One db level step is achieved by stepping the level reference voltage with the R. F. Power Level Control, see schematic 6104-800. The level loop follows modulation to above 1kHz and then rolls off rapidly to a loop crossover at about 20 kHz.

1-4 FREQUENCY CONTROL

The FREQUENCY CONTROL circuit shapes the input 10 volt ramp to a non-linear output of about 30 volts in the manner described in the 610B theory of operation. The control loop will handle FM rates up to 2 kHz; beyond this, its performance falls rapidly to a 30 kHz loop crossover frequency.

 (Page 2 is blank)

ADDENDUM TO WILTRON MODEL 6104 INSTRUCTION MANUAL

1. On the parts list page 13, change the descriptions as follows:

   Delete R601 and R605

2. On the parts list page 14, change the descriptions as follows:

   C605 should read 68pf
   C606 should read 5 pf 600V Fixed Ceram
   C608 should read 15pf
   C613 should read 68pf
   C614 should read 4.3pf Fixed Ti02

3. On the parts list, page 15, change the descriptions as follows:

   Capacitors

   C648 should read .002
   C704 should read .001 1Kv 10% Fixed Ceram
   C720 should read .02

   Inductors

   L601 should read .15uh
   L603 should read WILTRON M6104/AA
   L614 should read WILTRON M6104/AB

   Transistors

   Q603 should read 2N5179

4. On the parts list, page 16, change the descriptions as follows:

   Transistors

   Q802 should read 2N2405

   Delete Crystals.

SECTION 2

6104 PLUG-IN
RECALIBRATION PROCEDURE

2-1 INPUT REQUIRED FROM THE 610B MAIN FRAME

In order to have an accurately calibrated plug-in unit, the input voltages and waveforms from the 610B Main Frame must be correct. The table on the next page lists the important voltages and waveforms found at J401, the input to the plug-in located on the 610B rear panel. If the signal is incorrect or out of tolerance, the reference given along with each signal directs the operator to the appropriate section of the Recalibration Procedure. As a further aid in Recalibration, a simplified signal flow diagram (Fig. 2D) shows the major stages of the 6104 and the important voltages and waveforms indicated. Prior to checking the inputs from the Main Frame, make the front panel control settings as indicated in the opposite column. Allow 15 minutes warm-up time before making any measurements or adjustments.

610B/6104 FRONT PANEL CONTROL SETTINGS

FREQUENCY SELECTOR F1 to F2

RETRACE RF - OFF

F1 Frequency Control - 0

F2 Frequency Control - 100 MHz

SWEEP MODE - AUTO

SWEEP TIME - 1.0 - 0.1 sec.

SWEEP TIME VERNIER - FULL CW

MODULATION - NORMAL

VAR FREQ MARKER - INTENSITY

VAR FREQ MARKER AMP - FULL CCW

RF POWER LEVEL ATTENUATOR - 0 dbm (10 db per step)

RF POWER LEVEL - +3 dbm

RF POWER LEVEL VERNIER-CALIBRATE

Recalibration Procedure - cont'd.

TABLE 2A

c) Voltages and Waveforms on J401 with the 610B/6104 front panel controls set as indicated on the previous page.

PIN NO.	VOLTAGE OR WAVEFORM	RECALIBRATION REFERENCE
2	PROGRAMMED HIGH VOLTAGE, +80V d.c. ±5%	610B Section 7-2
6	Level control voltage -2V to -10V d.c. nominal range +2V to -18V d.c. maximum range	6104 Section 2-3
10	-5.6 V d.c.	610B Section 7-2
13	+30V d.c. ±10 mv	610B Section 7-2
15	Negative blanking to VCO +30 V during sweep, 0 V during retrace.	610B Section 7-17
16	External level control reference voltage -0.2V to -0.4V d.c. nominal range	6104 Section 2-6
18	Level Detector Output Voltage -0.2V to -0.4V d.c. nominal range	6104 Section 2-2 6104 Section 2-3
19	Level Regulator Reference Voltage -0.2V to -0.4V d.c. nominal range	6104 Section 2-3
22	-20V d.c. ±10 mv	610B Section 7-2
24	Sweep Waveform, see Fig. 7C in Sec. 7	610B Section 7-5

ecalibration Procedure - cont'd.

-2 R. F. AMPLIFIER GAIN TEST

a) Connect the output of the RF Signal Generator, described in the Required Test Equipment Section, to J701 the RF Amplifier input in the 6104. Set the Signal Generator frequency to 10 MHz.

b) Connect the RF power meter described in the Required Test Equipment Section to the RF output connection on the 6104 front panel.

c) With the 6104 front panel controls set as described previously in Section 2-1, Col. 2 adjust the signal level output of the Signal Generator to give a +3 dbm power level indication.

d) The minimum acceptable gain of the amplifier is 39 db. To calculate the gain of the amplifier, subtract the output of the signal generator in dbm from +13 dbm. For example, if the output of the signal generator is -28 dbm then the gain of the amplifier is +41 db.

e) Repeat steps a through d at 20, 40, 60, 80, and 100 MHz. The minimum gain at all frequencies is 39 db.

f) There are no gain adjustments in the 6104 RF amplifier, if the minimum gain is not met at any frequency see the 6104 Trouble Shooting Chart for steps to remedy the situation.

2-3 MULTIPLIER MIXER and LEVEL CONTROL RECALIBRATION

a) Set F1 to 20 MHz.
Set F2 to 100 MHz.
Set RETRACE RF to ON.
Set all other controls as described in preceding Section 2-1, Col. 2.
Connect the power meter to the R. F. output of the 6104. The power meter should read +3 dbm ±0. 3 db.

b) Connect 610B/6104 and a d. c. oscilloscope as shown in Fig. 2A.

Set all 610B/6104 controls as described in preceding Section 2-1, Col. 2.

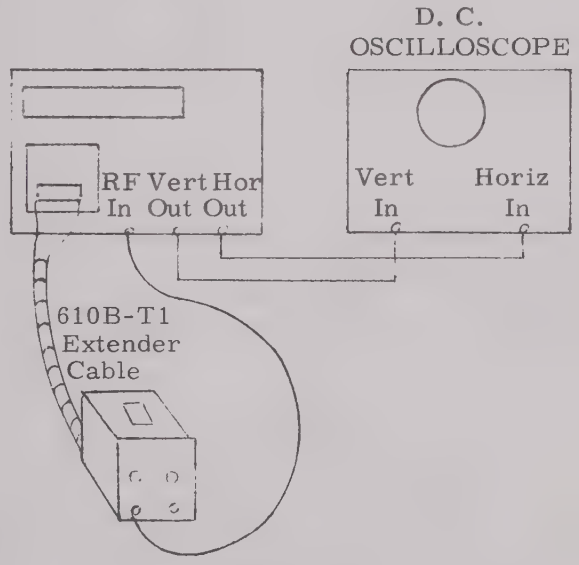


FIGURE 2A
610B/6104 RECALIBRATION CONFIGURATION

Adjust the vertical sensitivity of the d. c. oscilloscope so that a change in the RF Power Level Control from + 3 dbm to + 2 dbm will produce a change of 1 cm on the vertical scale of the oscilloscope graticule. This calibrates the oscilloscope to 1 db/cm at the + 3 dbm output of the 6104.

Recalibration Procedure - cont'd.

MULTIPLIER MIXER and LEVEL CONTROL RECALIBRATION -continued-

c) Observing the video signal of the detected RF output on the oscilloscope, turn the 1 db step RF Power Level switch on the 6104 through its entire range. Check the video signal for a leveled condition with no more than 0.3 db of level variation from 1 to 100 MHz on all positions. Also check to see that the unleveled condition light on the 610B Front panel stays off.

d) Turn the RF Power Level switch on the 6104 to + 3 dbm. Turn the RF Power Level Vernier full CW and observe a minimum of 1 db increase in video signal across the frequency band.

e) If any of the above conditions are not met, see Section 2-5 for adjustment procedures.

2-4 FREQUENCY ZERO RECALIBRATION

Before recalibration of the frequency zero is attempted the sweep signal on Pin 24 of J401 should be rechecked as described in TABLE 2A. If this waveform is incorrect, the frequency control circuits will not respond properly and any adjustment of them will put the instrument farther out of calibration than it already is.

a) Set F1 frequency control - 0
Set F2 frequency control - 10 MHz
Set all other controls as described in Section 2-1, Column 2.
Connect the 610B/6104 and d.c. oscilloscope as shown in Figure 2A.
Turn on the 1 MHz Harmonic Marker Generator and adjust the MARKER AMPLITUDE until the markers are visible.

b) Adjust the oscilloscope Horizontal sensitity for a 10 cm horizontal trace. The video presentation on the oscilloscope should show the zero frequency signal and the 10 1 MHz harmonic markers corresponding to a 1 to 10 MHz frequency sweep. See Figure 2B for a representation of the desired display.

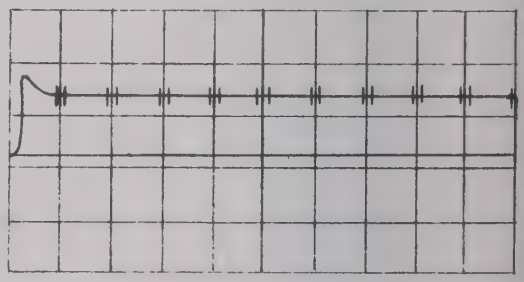


Figure 2B

0 to 10 MHz Sweep with 1 MHz Harmonic Markers as seen on an oscilloscope with a rectangular graticule.

c) If the zero frequency point is not at the left end of the trace when all the controls are properly set, the ZERO FREQUENCY ADJUST R811 in the 6104 can be adjusted to set the zero frequency at the start of the sweep.

ecalibration Procedure - cont'd.

5 ADJUSTMENTS

a) Multiplier Mixer Tuning

SET MODULATION to XTAL. Set all other controls as described in Section 2-1, Column 2. Connect the 610B/6104 and oscilloscope as shown in Figure 2A.

1. Observe the detected R.F. signal displayed on the d.c. oscilloscope. The waveform should appear similar to Figure 2C. This is the unleveled output of the 6104. There should be a monotonic fall off of gain with frequency.

2. The dotted line in Figure 2C indicates a mistuned multiplier mixer; this waveform may be adjusted by tuning C620 on the 6104 deck.

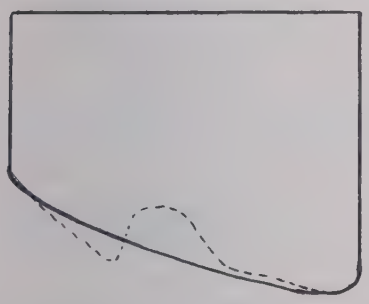


Figure 2C

UNLEVELED OUTPUT FROM THE 6104

3. Only if there is an output problem tune C620, C623, C624, C625 and C626 located on the 6104 main deck for a maximum amplitude signal as shown in Figure 2C. C607 and C615 relate to the 50 MHz oscillator and should not be adjusted as long as the oscillator is working properly.

b) LEVEL CAL. adjust

Set F1 - 20 MHz
Set F2 - 100 MHz
Set RETRACE RF - ON
Set all other controls as described in Section 2-1, Column 2.
Connect power meter to the RF output of the 6104. The power meter should read +3 dbm. If it does not, adjust R839 LEVEL CAL in the 6104 for a reading of + 3 dbm ±0.1 db.

NOTE: Check level control recalibration Sec. 7-7 before adjusting LEVEL CAL.

6104 TROUBLE SHOOTING CHART

GENERAL

INDICATION	POSSIBLE CAUSE AND REMEDY
No RF OUTPUT or unleveled RF OUTPUT	a) Check front panel control settings. See Section 2-1, Column 2. b) Defective output from 610B main frame. Check voltages and waveforms indicated in Table 2 A. c) RF Amplifier defective. See Section 2-2. d) Voltage controlled oscillator defective. Check for +9 dbm ±1 db output from VCO located on the rear panel of the 6104. e) Multiplier Mixer stage defective. Check for -24 dbm ±1 db output from the multiplier mixer assembly with the VCO input to the mixer disconnected. See Section 2-3 for recalibration procedure.
No Horizontal Sweep	a) See 610B Trouble Shooting Chart
RF POWER LEVEL CONTROL and POWER LEVEL VERNIER have no control over the RF output	a) Check front panel control settings. See Section 2-1, Col. 2. b) Defective level control voltage check voltages and waveforms indicated in Table 2 A.
No RF Pip	a) See 610B Trouble Shooting Chart
RF Amplifier has low gain or no output signal	a) Check output of VCO and multiplier mixer stages. See NO RF output above. b) Check d.c. supply voltages. See Table 2 A. c) Replace Q705. d) Replace other transistors in the RF amplifier starting with Q704.

6104 TROUBLE SHOOTING CHART

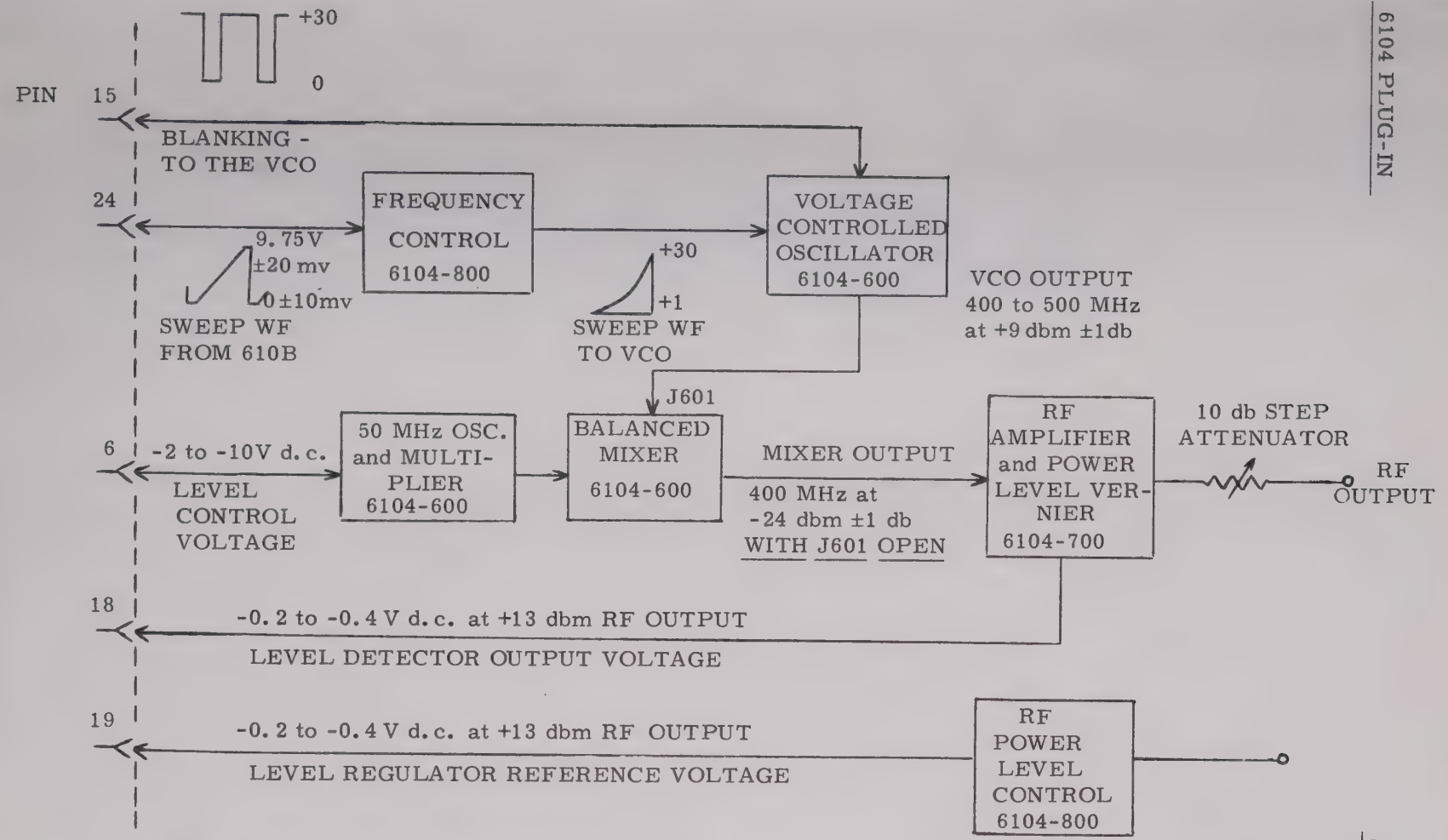
GENERAL Cont'd.

INDICATION	POSSIBLE CAUSE AND REMEDY
No output from Multiplier Mixer Stage	a) 50 MHz oscillator inoperative, tune C607 and C615 on the 610B main deck to start oscillator operation. b) Check d. c. conduction of all transistors in the Multiplier Mixer Assembly. c) Check for -18V on Pin 6 of J401. If this voltage is absent or is a positive value, see cannot ADJ 610B level balance control in the 6104 Trouble Shooting Chart.
No output from the Voltage Controlled Oscillator	a) Check sweep input to VCO, See 6104 signal flow diagram 2 D. b) Check blanking into VCO at Pin 15 of J401. See Table 2 A. c) Check d. c. conduction of VCO Transistors.
Level light on 610B front panel stays on	a) Check front panel control settings. See Section 2-1, Column 2. b) Cables unhooked in the 6104 or improperly connected. c) Check 610B LEVEL BALANCE control. See Section 7-7.
Cannot adjust RF output to +13 dbm with LEVEL CAL control	a) Check control settings. See Section 2-3 (a). In particular be sure the RETRACE RF switch is ON. b) Check the outputs of the RF amplifier. Voltage controlled oscillator and Multiplier Mixer stages. See Section 2 - 2 and No RF output above in the Trouble Shooting Chart. c) Check setting of 610B LEVEL BALANCE control. See Section 7-7.

6104 TROUBLE SHOOTING CHART

GENERAL Cont'd.

INDICATION	POSSIBLE CAUSE AND REMEDY
Cannot adjust 610B LEVEL BALANCE control	a) Check for proper voltages on Pins 18 and 19 of J401. b) Check Q401 and Q402 located on the 610B-4A Printed card for balanced conduction when the LEVEL BALANCE control is in the center of its range. c) Check all other transistors in the level regulator circuit for d.c. conduction.



NOTES:

1. All 610B/6104 controls are set as stated in Section 2-1, Column 2.
2. Numbers inside boxes indicate appropriate 6104 schematic numbers.

FIGURE 2 D

SIMPLIFIED SIGNAL FLOW DIAGRAM FOR THE 6104

MODEL 6108

PLUG-IN (10 MHz - 1000 MHz)

INSTRUCTION MANUAL

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(Also see 610B MANUAL)

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1-3 FREQUENCY CONTROL
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1-5 10 - 550 MHz BAND

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2-3 FREQUENCY CONTROL RECALIBRATION
2-4 LEVEL CONTROL RECALIBRATION
2-5 FREQUENCY CONTROL ADJUSTMENTS
2-6 LEVEL CONTROL ADJUSTMENTS
2-7 6108 TROUBLE SHOOTING GUIDE

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SCHEMATICS and FLOW DIAGRAM — SECTION 4

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ADDENDUM TO WILTRON MODEL 6108 INSTRUCTION MANUAL

1. On the parts list page 11, change the description as follows:

   R736 should read 91
   R623 should read 12K

2. On the parts list page 12, the description should be as follows:

   Add:

R867	1K	1/4W	5%	Fixed Comp

   Capacitors

   C614 should read 47pf
   C615 should read 47 pf
   C701 should read 20pf

3. On the parts list page 13, the description should be as follows:

   Transistors

   Add Q861 2N5109

SECTION 1

MODEL 6108 PLUG-IN
THEORY OF OPERATION

1-1 GENERAL

The Model 6108 divides the 10 to 1000MHz spectrum into two bands. The top band functions as a direct oscillator covering 550 to 1000 MHz. The lower band uses the heterodyne technique to generate 10 to 500 MHz which is amplified to deliver 1v rms at the output. Both bands utilize the same voltage controlled oscillator, isolation amplifier and PIN diode leveling attenuator. A coaxial switch makes the necessary circuit changes for band switching as shown in the 6108 flow diagram. A portion of the output is extracted for the birdie mixer.

1-2 R.F. GENERATOR AND LEVELER

The voltage controlled oscillator is a packaged transistor oscillator covering the range 550 to 1155 MHz for a control voltage of -1.5 to +60 volts. The output is link coupled to the isolation amplifier, Q602 of schematic 6108-600. The transistor Q601 acts as a saturating switch to provide collector voltage for the oscillator. For R.F. off during retrace the blanking signal opens the switch and no R.F. is generated. The isolation amplifier feeds an attenuator with one PIN diode in series and another in shunt. This configuration gives a wide dynamic range and maintains a good match so that the oscillator frequency does not change as the signal level is varied. A fixed bias current is provided by R625 which supplements the variable current from the emitter follower Q603. The base voltage of Q603 is near -18 volts for minimum attenuation and near 0 volts for maximum.

1-3 FREQUENCY CONTROL

The frequency control circuit shapes the input 10 volt ramp to a non-linear output of 60 volts in the manner described in the 610B theory of operation. The control loop will handle fm rates up to 3kHz, falling rapidly beyond this to the loop crossover frequency of 50 kHz. The shaping establishes the relation 0 to +10 volts input for 550 to 1155 MHz output. A divider at the input is controlled by the bandswitch, S601, so that the input 10 volt ramp becomes 0 to 7.4 to generate the high band and 0.91 to 10 to sweep the low band. See schematic 6108-800.

1-4 550-1000 MHz BAND

For this band the R.F. signal from the leveler is connected through a 1000MHz low-pass filter and a 10db directional coupler to the output terminal. The filter removes all harmonics and the coupler samples the incident energy which is detected and used for leveling. This establishes the 50 ohm output impedance. The level regulator amplifier (see 610B Theory of Operation) controls Q603 which drives the PIN diode leveler.

1-5 10-550 MHz BAND

The output of the leveler is switched to a 1155 MHz low-pass filter feeding a doubly balanced mixer. A high level fixed 605MHz signal from the oscillator Q861, see schematic 6108-800, is fed to the other mixer input. The difference frequency 0 to 550MHz is coupled through a 550 MHz low-pass filter to the power amplifier of schematic 6108-700.

10-550 MHz Band - cont'd.

This amplifier consists of five cascaded common emitter stages followed by a feedback pair which delivers 2 v rms to R737. A divider R735, 736 couples this same signal to the detector CR701, for leveling. The leveling action keeps the voltage constant at the top of R735 thus creating a zero impedance source.

The 49.9 ohm series resistor, R737, establishes the 50 ohm output impedance and reduces the output level to 1v rms. A single R.F. Power Level control sets the level reference voltage for either band since the low band level detector is attenuated to agree with the high band for large output levels as shown in schematic 6108-600. The level loop follows modulation to above 10 kHz and then rolls off rapidly to a loop crossover at about 200 kHz.

6108 PLUG-IN
RECALIBRATION PROCEDURE

1 INPUT REQUIRED FROM THE 610B MAIN FRAME

In order to have an accurately calibrated plug-in unit, the input voltages and waveforms from the 610B Main Frame must be correct. The table on the next page lists the important voltages and waveforms found at J401, the input to the plug-in located on the 610B rear panel. If the signal is incorrect or out of tolerance, the reference given along with each signal directs the operator to the appropriate section of the Recalibration Procedure. As a further aid in Recalibration, simplified signal flow diagrams (Fig. 2 D and 2 E) are given with the major stages of the 6108 and the important voltages and waveforms indicated. Prior to checking the inputs from the Main Frame, make the front panel control settings as indicated in the opposite column. Allow 15 minutes warm-up time before making any measurements or adjustments.

610B/6108 FRONT PANEL CONTROL SETTINGS

FREQUENCY SELECTOR F1 to F2

RETRACE RF - OFF

F1 Frequency Control - 0

F2 Frequency Control - 1000 MHz

SWEEP MODE - AUTO

SWEEP TIME - 1.0 - 0.1 sec.

SWEEP TIME VERNIER - FULL CW

MODULATION - NORMAL

VAR FREQ MARKER - INTENSITY

VAR FREQ MARKER AMP - FULL CCW

RF POWER LEVEL - MAX

FREQUENCY BAND - HIGH

Recalibration Procedure - cont'd.

TABLE 2A

c) Voltages and Waveforms on J401 with the 610B/6108 front panel controls set as indicated on the previous page.

PIN NO.	VOLTAGE OR WAVEFORM	RECALIBRATION REFERENCE
2	PROGRAMMED HIGH VOLTAGE, +95 V d.c. ±5%	610B Section 7-2
6	Level control voltage -10 to -17 V d.c. nominal range +2 to -18 V d.c. maximum range	610B Section 7-7
10	-5.6 V d.c.	610B Section 7-2
13	+30 V d.c. ±10 mv	610B Section 7-2
15	Negative blanking to VCO +30 during sweep, 0 during retrace	610B Section 7-17
16	External level control reference voltage -0.1 V to -0.3 V d.c. nominal range	6108 Section 2-7
18	Level Detector Output Voltage -0.2 V to -0.4 V d.c. nominal range	6108 Section 2-3
19	Level Regulator Reference Voltage -0.1 V to -0.3 V d.c. nominal range	6108 Section 2-3
22	-20 V d.c. ±10 mv	610B Section 7-2
24	Sweep Waveform, See Fig. 7C	610B Section 7-5

Recalibration Procedure - cont'd.

2-2 6108 MECHANICAL INSPECTION

a) To obtain the best performance from the 6108, all covers should be securely attached to their subassemblies and the subassemblies mounted to the 6108 Frame.

NOTE: The cover screws on the Voltage Controlled Oscillator and the Mixer subassemblies are sealed with gliptal and should not be tightened or loosened; adjustment of these screws will cause a deterioration of the 6108 overall performance.

b) Check to see that all BNC connections are tight and that there are no broken or chaffed wires in the plug-in.

c) Take special care to see that the 5-500 MHz R.F. AMPLIFIER is securely mounted to the 6108 main deck and that its cover is screwed on and grounded to the braiding on the main deck.

2-3 FREQUENCY CONTROL RECALIBRATION

a) If there is any question as to the R.F. frequency being observed, the operator should refer to Section 3 of the 610B Instruction Manual for Frequency Measurement Procedures.

b) Set FREQUENCY SELECTOR-CWF1. Set all other Front Panel controls as described in Section 2-1, Column 2. With the F1 Frequency Control set exactly on 550 MHz, check the R.F. frequency output for 550MHz ±5 MHz.

c) Set FREQUENCY SELECTOR-CWF1
FREQUENCY BAND - LOW
F1 Frequency Control - 10 MHz

Set all other Front panel controls as described in Section 2-1, Column 2. With the F1 Frequency Control set exactly on 10 MHz, check the R.F. output for 10 MHz ±5 MHz.

d) If either of the frequencies measured in Steps b and c above are out of tolerance, see Section 2-5 for the Adjustment Procedures.

2-4 LEVEL CONTROL RECALIBRATION

Set all Front Panel controls as described in Section 2-1, Column 2.

a) Connect the 610B/6108 and a d.c. coupled oscilloscope as shown in Figure 2-A. Observe the detected R.F. output on the oscilloscope. The video should appear as shown in Fig. 2-B. The video should be flat across the band ±0.3 db and the Unleveled Indication light on the 610B front panel should be off.

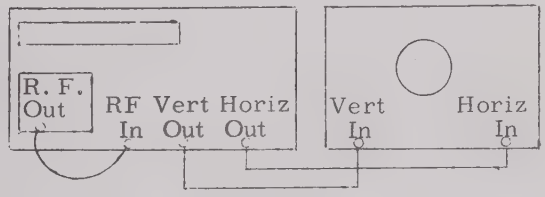


Figure 2-A
610B/6108 and D.C. OSCILLOSCOPE TEST CONFIGURATION

Turn the R.F. Power Level Control CCW to its minimum position and observe that the R.F. stays leveled and the Unleveled light stays off.

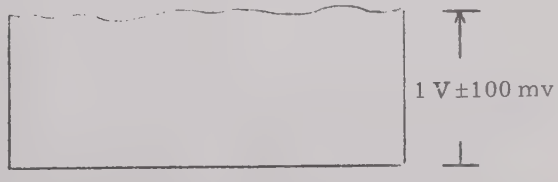


Figure 2-B
DETECTED 6108 R.F.
AS SEEN ON AN OSCILLOSCOPE

Recalibration Procedure - cont'd.

LEVEL CONTROL RECAL. -continued-

b) Turn the 6108 FREQUENCY BAND to LOW and repeat step a.

c) Connect an R.F. Power Meter to the R.F. output of the 6108.
Set RETRACE R. F. to ON.
Set all the other controls as described in Section 2-1, Column 2.
The power output of the 6108 High band should be at least +13dbm ±0.3dB.

d) Turn the 6108 FREQUENCY BAND to LOW and check that the power meter reading is the same as for the high band, ± 0.3dB.

e) If any of the measurements made in steps a through d are out of tolerance, see Section 2-6 for the Level Control Adjustments.

2-5 FREQUENCY CONTROL ADJUSTMENTS

a) Connect the 610B/6108 as shown in Figure 2-C for access to internal controls.
Set FREQUENCY SELECTOR-CWF1.
Set all other Front Panel controls as described in Section 2-1, Column 2.

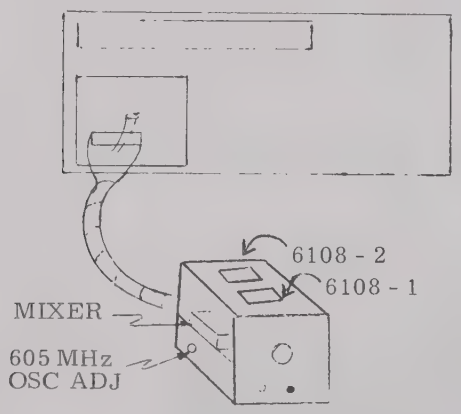


Figure 2-C
610B/6108 and EXTENDER CABLE

With the F1 control set exactly on 0 (550 on high band), adjust R811 560 MHz ADJ located on the 6108-2 Printed Card to bring the frequency of the R.F. output to 550 MHz±2 MHz.

b) Set all Front Panel controls as described in Section 2-1, Column 2. Disconnect P610 from the mixer block assembly (center BNC connector with the small white coax cable) and connect it to the frequency measuring circuit being used. This is the output from the 605 MHz oscillator. The output from this oscillator should be 605 MHz ±1 MHz. If this frequency is out of tolerance it may be adjusted by a screwdriver adjustment on the left side of the 6108 located near rear of the instrument. See Figure 2-C for the adjustment location. Re-connect the cable to the mixer after making the adjustment.

c) Set FREQUENCY SELECTOR-CWF1. Set 6108 FREQUENCY BAND to LOW. Set all the others controls as described in Section 2-1, Column 2.

With the F1 Frequency Control set exactly on 10 MHz, adjust R853 10 MHz ADJ, located on the 6108-2 Printed Card, for an R.F. output frequency of 10 MHz ±2 MHz.

d) If it is impossible to accomplish any of the above steps, See Section 2-7 for Trouble Shooting suggestions.

2-6 LEVEL CONTROL ADJUSTMENTS

a) Check Level Control Recalibration procedure Section 7-7 in the 610B manual.

Recalibration Procedure - cont'd.

2-6 Level Control Adjustments - continued-

b) Set RETRACE R. F. to ON. Set all the other Front Panel controls as described in Section 2-1, Column 2. Connect the R.F. Power Meter to the R.F. output of the 6108. With the R.F. POWER LEVEL control turned Full CW, adjust R624 UPPER LEVEL LIMIT located on the 6108-2 PC for an output of at least +13dBm (±0.3dB).

c) Turn the 6108 FREQUENCY BAND to LOW and adjust R618 LEVEL EQUALIZE located on the 6108-2 Printed Card for the same output as in step b preceding.

d) Connect the 610B/6108 and a d.c. coupled oscilloscope as shown in Figure 2-A. With the 610B/6108 Front Panel controls set as described in Section 2-1, observe the detected R.F. signal as described in Section 2-4, (a). Check the Low band for a similar detected R.F. signal.

e) Set all controls as described in Section 2-1. Turn the R.F. POWER LEVEL CONTROL CCW to its minimum position. Adjust R619 LOWER LEVEL LIMIT until the detected R.F. just becomes unleveled and the Unleveled Indication light on the 610B Front Panel comes on. Check for this condition on both frequency bands. On the band that will stay unleveled when the other band is leveled, adjust R619 so that the detected R.F. is about 1/2 db above the point where it becomes unleveled.

f) If it is impossible to perform any of the above steps see Sec. 2-7 for Trouble Shooting suggestions.

Recalibration Procedure - cont'd.

2-7 TROUBLE SHOOTING GUIDE

The R.F. circuitry in the 6108 is carefully adjusted and tuned at the factory for optimum performance. The exact placement of wires and components is of critical importance in the 6108 and it is therefore recommended that trouble shooting of the RF circuitry be limited to isolating the problem to a stage and haveing the factory repair or replace the defective stage.

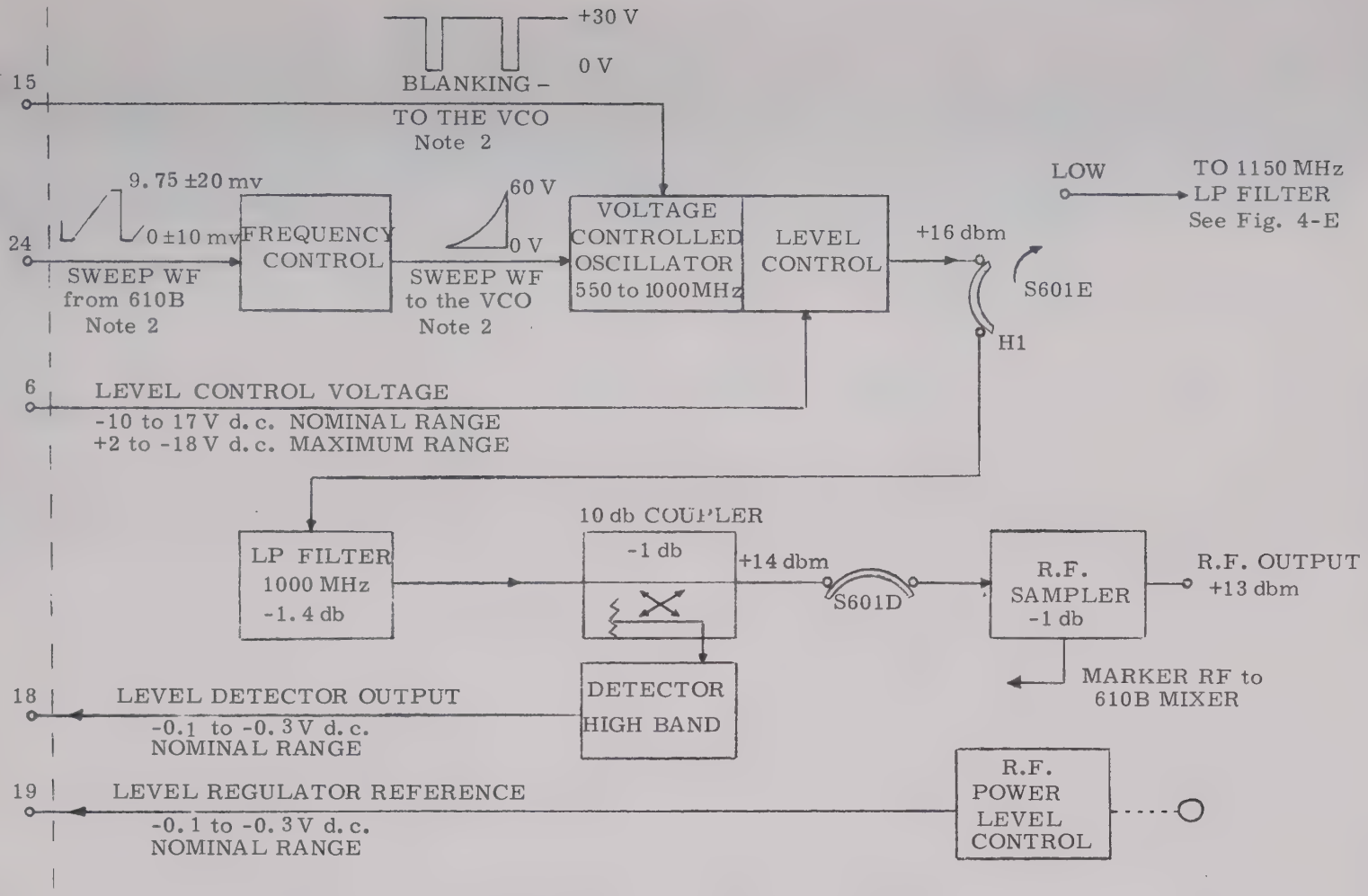
Figures 2-D and 2-E should be used as a guide in isolating problems to a single stage in the instrument.

It is assumed that the 610B Main Frame is functioning correctly. (See Table 2-A for important signals from the 610B).

TABLE 2-B

6108 TROUBLE SHOOTING GUIDE

INDICATION	POSSIBLE CAUSE and REMEDY
No. R.F. output on either band.	1. Set controls as described in Sec. 2-1 and check for voltages in Table 2-A. 2. Check for loose internal coax connector. 3. Check voltages and waveforms as shown in Figure 2-D to find defective stage. 4. Defective cable connected to R.F. OUTPUT.
No R.F. output on low band, high band okay.	1. Check signals shown in Figure 2-E to find defective stage.
Low R.F. output on band.	1. See Level Recalibration Procedure, Section 2-4. 2. Defective internal detector. 3. Check for proper signal levels as shown in Figure 2-D.
LOW BAND R.F. is unleveled; high band okay.	1. Check for loose cover or other mechanical defect. See Sec. 2-2. 2. See Level Recalibration Procedure, Section 2-4. 3. Check for proper signal levels as shown in Figure 2-E.



NOTE: 1. All power readings taken at maximum power output with 610B RETRACE R.F. switch in the ON position.

2. Controls set as described in Section 2-1, Column 2.

Figure 2-D SIMPLIFIED 6108 HIGH BAND SIGNAL FLOW DIAGRAM

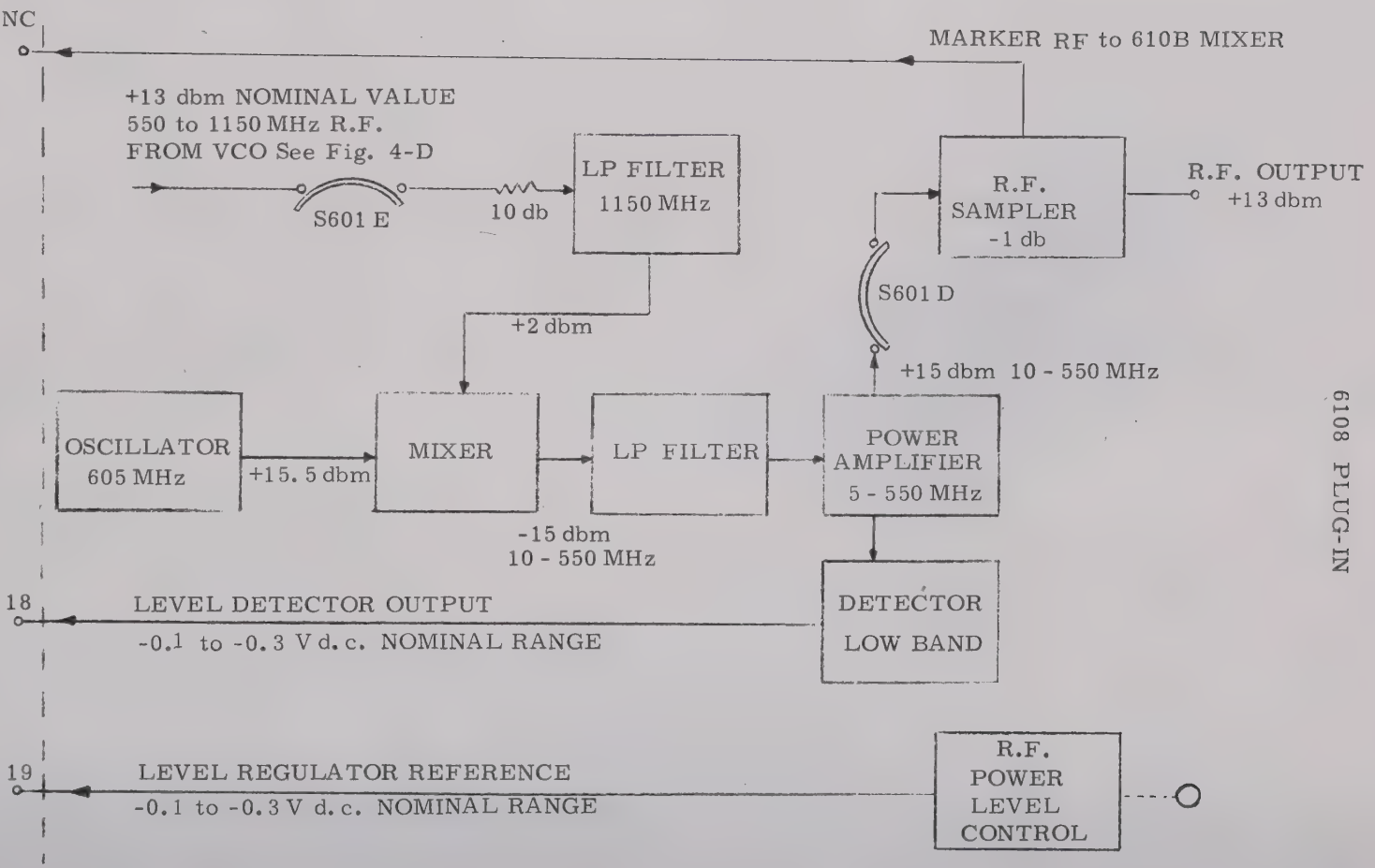


Figure 2-E SIMPLIFIED 6108 LOW BAND SIGNAL FLOW DIAGRAM

NOTE: All power readings taken at maximum power output with the 610B RETRACE R.F. switch in the ON position.

Resistors

R601	2.74K	1/8W	1%	Fixed	Film
R602	150	3W	5%	Fixed	WW
R603					
R604	220	3W	5%	Fixed	WW
R605	51	1/4W	5%	Fixed	Comp
R606	220	3W	5%	Fixed	WW
R607	270	3W	5%	Fixed	WW
R608	39	1/4W	5%	Fixed	Comp
R609	10K	1/4W	5%	Fixed	Comp
R610	7.5K	1/4W	5%	Fixed	Comp
R611	820	1/4W	5%	Fixed	Comp
R612	150	1/4W	5%	Fixed	Comp
R613	150	1/4W	5%	Fixed	Comp
R614	1K	1/4W	5%	Fixed	Comp
R615	750	1/4W	5%	Fixed	Comp
R616					
R617	2K	1/4W	5%	Fixed	Comp
R618	2K			Var	WW
R619	500			Var	WW
R620	1K			Var	WW
R621	360	1/4W	5%	Fixed	Comp
R622	470	1/4W	5%	Fixed	Comp
R623	15K*	1/4W	5%	Fixed	Comp
R624	5K			Var	WW
R625					
R626	30K	1/4W	5%	Fixed	Comp
R627	330	1/4W	5%	Fixed	Comp
R628	1.1K	1W	5%	Fixed	Comp
R629	910	1/2W	5%	Fixed	Comp
R630	6.2K	1/4W	5%	Fixed	Comp
R701	56	1/4W	5%	Fixed	Comp
R702	10K	1/4W	5%	Fixed	Comp
R703	1.2K	1/4W	5%	Fixed	Comp
R704	750	1/4W	5%	Fixed	Comp
R705	240	1/4W	5%	Fixed	Comp
R706	8.2K	1/4W	5%	Fixed	Comp
R707	1.2K	1/4W	5%	Fixed	Comp
R708	820	1/4W	5%	Fixed	Comp
R709	200	1/4W	5%	Fixed	Comp
R710	6.2K	1/4W	5%	Fixed	Comp
R711	910	1/4W	5%	Fixed	Comp
R712	750	1/4W	5%	Fixed	Comp
R713	120	1/4W	5%	Fixed	Comp
R714	18	1/4W	5%	Fixed	Comp
R715	5.1K	1/4W	5%	Fixed	Comp

Resistors

R716	680	1/4W	5%	Fixed	Comp
R717	560	1/4W	5%	Fixed	Comp
R718	68	1/4W	5%	Fixed	Comp
R719	1.8K	1/4W	5%	Fixed	Comp
R720	820	1/4W	5%	Fixed	Comp
R721	560	2W	5%	Fixed	Comp
R722	100	1/2W	5%	Fixed	Comp
R723	36	1/4W	5%	Fixed	Comp
R724	820	1/4W	5%	Fixed	Comp
R725	1.8K	1/4W	5%	Fixed	Comp
R726	560	2W	5%	Fixed	Comp
R727	100	1/2W	5%	Fixed	Comp
R728	750	1/4W	5%	Fixed	Comp
R729	270	1/4W	5%	Fixed	Comp
R730	130	1/4W	5%	Fixed	Comp
R731	820	1/4W	5%	Fixed	Comp
R732	150	2W	5%	Fixed	Comp
R733	150	2W	5%	Fixed	Comp
R734	110	1/4W	5%	Fixed	Comp
R735	300	1/4W	5%	Fixed	Comp
R736	82	1/4W	5%	Fixed	Comp
R737	49.9	1/8W	1%	Fixed	Film
R738					
R739					
R740					
R741					
R742	150	1/4W	5%	Fixed	Comp
R743	36	1/4W	5%	Fixed	Comp
R744	150	1/4W	5%	Fixed	Comp
R746	33	1/4W	5%	Fixed	Comp
R748	130	1/4W	5%	Fixed	Comp
R801	160K	1/4W	5%	Fixed	Comp
R802	270K	1/4W	5%	Fixed	Comp
R803	620K	1/4W	5%	Fixed	Comp
R804	3.3K	1/4W	5%	Fixed	Comp
R805	3.3K	1/4W	5%	Fixed	Comp
R806	8.2K	1W	5%	Fixed	Comp
R807	10K	1/4W	5%	Fixed	Comp
R808	270	1/4W	5%	Fixed	Comp
R809	20K	1/8W	1%	Fixed	Film
R810					
R811	10K			Var	WW
R812					
R813					

* Factory selected value

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Resistors

R814	10K	1/4W	1%	Fixed	Film
R815	10K	1/4W	1%	Fixed	Film
R816	240K	1/4W	5%	Fixed	Comp
R817	A thru J	Factory Selected Values			
R818	1K	1/8W	1%	Fixed	Film
R819	66.5	1/8W	1%	Fixed	Film
R820	80.6	1/8W	1%	Fixed	Film
R821	97.6	1/8W	1%	Fixed	Film
R822	93.1	1/8W	1%	Fixed	Film
R823	75.0	1/8W	1%	Fixed	Film
R824	54.9	1/8W	1%	Fixed	Film
R825	43.2	1/8W	1%	Fixed	Film
R826	34.8	1/8W	1%	Fixed	Film
R827	37.4	1/8W	1%	Fixed	Film
R828	48.7	1/8W	1%	Fixed	Film
R843	1K*	1/4W	5%	Fixed	Comp
R845	560	1/4W	5%	Fixed	Comp
R846	1.43K	1/8W	1%	Fixed	Film
R847	604K	1/8W	1%	Fixed	Film

Capacitors

C601	1000pf	500V	feed thru	Fixed	Ceram
C602	.01μf	500V	20%	Fixed	Ceram
C603	1000pf	500V	feed thru	Fixed	Ceram
C604	1000pf	500V	feed thru	Fixed	Ceram
C605	1000pf	500V	feed thru	Fixed	Ceram
C606	1000pf	500V	feed thru	Fixed	Ceram
C607	1000pf	500V	feed thru	Fixed	Ceram
C608	1000pf	500V	feed thru	Fixed	Ceram
C609	1000pf	500V	feed thru	Fixed	Ceram
C610	27pf	500V	5%	Fixed	Mica
C611	470pf	500V	feed thru	Fixed	Ceram
C612	.0047μf	500V	20%	Fixed	Ceram
C613	.001μf	1KV	10%	Fixed	Ceram
C614	100pf*	500V	5%	Fixed	Mica
C615	100pf*	500V	5%	Fixed	Mica
C616	.0027μf	600V	10%	Fixed	Mylar
C617					
C618	470pf	500V	5%	Fixed	Mica
C619	.0027μf	600V	10%	Fixed	Mylar
C620	470pf	500V	5%	Fixed	Mica
C621	470pf	500V	feed thru	Fixed	Ceram
C622	.68pf	500V	5%	Fixed	Ti02
C623	32μf	64V		Fixed	Lytic

Resistors

R848	51K*	1/4W	5%	Fixed	Comp
R849					
R850	4.99	1/8W	1%	Fixed	Film
R851	14.7K	1/8W	1%	Fixed	Film
R852	37.4K	1/8W	1%	Fixed	Film
R853	10K			Var	WW
R854	20K	1/8W	1%	Fixed	Film
R855	9.76K	1/8W	1%	Fixed	Film
R856	20K	1/4W	5%	Fixed	Comp
R857	20K	1/4W	5%	Fixed	Comp
R861	2K	1/2W	5%	Fixed	Comp
R862	2K	1/2W	5%	Fixed	Comp
R863	330	1/2W	5%	Fixed	Comp
R864	110	1/4W	5%	Fixed	Comp
R865	62	1/4W	5%	Fixed	Comp
R866	110	1/4W	5%	Fixed	Comp
R867	1K	1/4W	5%	Fixed	Comp

Capacitors

C624	.1μf	500V	20%	Fixed	Ceram
C625	.047μf	400V	10%	Fixed	Mylar
C701	15pf	500V	5%	Fixed	Mica
C702					
C704	1000pf	500V	feed thru	Fixed	Ceram
C705	22pf	500V	5%	Fixed	Mica
C706	100pf	500V	5%	Fixed	Mica
C707					
C708	1000pf	500V	feed thru	Fixed	Ceram
C709	5pf	500V	5%	Fixed	Mica
C710	100pf	500V	5%	Fixed	Mica
C711	1000pf	500V	feed thru	Fixed	Ceram
C712	15pf	500V	5%	Fixed	Mica
C713	27pf	500V	5%	Fixed	Mica
C714	100pf	500V	5%	Fixed	Mica
C715	1000pf	500V	feed thru	Fixed	Ceram
C716	7pf	500V	5%	Fixed	Mica
C717	100pf	500V	5%	Fixed	Mica
C718	1000pf	500V	feed thru	Fixed	Ceram
C719	10pf	500V	5%	Fixed	Mica
C720	15pf	500V	5%	Fixed	Mica

*Factory selected value

Capacitors

C721	100pf	500V	5%	Fixed	Mica
C722	1000pf	500V	feed thru	Fixed	Ceram
C723	1000pf	500V	feed thru	Fixed	Ceram
C724					
C725	5pf	500V	5%	Fixed	Mica
C726	.001μf	1KV	10%	Fixed	Ceram
C727	3.3pf	500V	5%	Fixed	Ti02
C728	1000pf	500V	feed thru	Fixed	Ceram
C729	1000pf	500V	feed thru	Fixed	Ceram
C730	.01μf	500V	20%	Fixed	Ceram
C731	.01μf	500V	20%	Fixed	Ceram
C732	.01μf	500V	20%	Fixed	Ceram
C733	1000pf	500V	feed thru	Fixed	Ceram
C734	2.2pf	500V	5%	Fixed	Ti02
C735					
C736	1000pf	500V	feed thru	Fixed	Ceram
C737	1000pf	500V	feed thru	Fixed	Ceram
C738	1000pf	500V	feed thru	Fixed	Ceram
C739	6.8μf	35V		Fixed	Lytic
C740	6.8μf	35V		Fixed	Lytic

Transistors

Q601	2N3568	Q706	2N5109
Q602	2N5109	Q707	2N5109
Q603	2N3566		
Q604	2N3568		
Q605	2N3568		
Q701	2N3653	Q801	2N4249
Q702	2N3563	Q802	2N2405
Q703	2N3563	Q803	2N4045
Q704	2N3563	Q804	2N3565
Q705	2N5109	Q861	

Diodes

CR601	HPA3001	CR701	PD0831
CR602	HPA3001	CR801 A thru J	1N4466
CR603	1N4446	CR802	1N4446
CR604	1N4446	CR803	1N4446

Inductors

L601	Wiltron No. 6108/C
L602	Wiltron No. 6108/B
L603	Wiltron No. 6108/A
L701	Wiltron No. 6108/A
L702	.33μh
L703	Wiltron No. 6108/F
L704	10μh
L705	.33μh
L706	Wiltron No. 6108/D

Capacitors

C741	6.8μf	35V		Fixed	Lytic
C742	1000pf	500V	feed thru	Fixed	Ceram
C743	10pf	500V	5%	Fixed	Mica
C744	2.2pf	500V	5%	Fixed	Ti02
C745	3.3pf	500V	5%	Fixed	Ti02
C747	.68pf*	500V	5%	Fixed	Ti02
C801	390pf	500V	10%	Fixed	Mica
C802	.022μf	250V	10%	Fixed	Mylar
C803	22pf	500V	5%	Fixed	Ceram
C804	7pf	500V	5%	Fixed	Mica
C807	.001μf	500V	20%	Fixed	Ceram
C810	.001μf	500V	20%	Fixed	Ceram
C861	1000pf	500V	feed thru	Fixed	Ceram
C862	1000pf	500V	feed thru	Fixed	Ceram
C863	1000pf	500V	feed thru	Fixed	Ceram
C864	.68pf	500V	5%	Fixed	Ti02
C865	.5-3pf			Var	Ceram
C866	5pf	500V	5%	Fixed	Mica
C867	5pf	500V	5%	Fixed	Mica
C868	5pf	500V	5%	Fixed	Mica
C869	5pf	500V	5%	Fixed	Mica

Inductors

L707	10μh
L708	.33μh
L709	Wiltron No. 6108/D
L710	10μh
L711	.33μh
L712	Wiltron No. 6108/F
L713	10μh
L714	Wiltron No. 6108-S-847
L715	.33μh
L716	Wiltron No. 6108-S-847
L717	10μh
L718	Wiltron No. 6108-S-847
L719	10μh
L720	.33μh
L721	Wiltron No. 6108-S-847
L722	10μh
L723	.33μh
L724	Wiltron No. 6108/E
L725	Wiltron No. 6108-S-847
L861	Wiltron No. 6108-S-805
L862	Wiltron No. 6108-S-805
L863	Wiltron No. 6108/D
L864	Wiltron No. 6108/D
L865	Wiltron No. 6108/E

*Factory selected value

Transformer

T861	Wiltron No. 6108-S-798

Miscellaneous

J801	UG-556B/U	
P801	Amphenol	26-159-24
LATCH	Southco	48-10-101-10

RF Components

550 to 1155 MHz VCO	Wiltron No. 6108-MS-246
RF Mixer Assembly	Wiltron No.
10db Coupler	Wiltron No.
High Band Detector	Wiltron No. 61D
1155 MHz LP Filter	Telonic TLP115-8AB1
1000 MHz LP Filter	Telonic TLP1000-8AB1
550 MHz LP Filter	Telonic TLP550-8AB1
10 db Pad	Texscan FP-50
S601-RF Switch	Telonic SW-20
Signal Sampler	Wiltron No. 6108-S-797
RF Cables	Wiltron No. 6108-S-804D

6108 J401 | 6108 P801

+30V

R602 150

Q601 2N3568

R601 2740

BLANKING (DWG 6108-100)

R630 6.2K

CONTROL VOLTAGE FROM P.N 6 6104/8-1

C602 .01μf

C603 1000

ISOLATION AMPLIFIER

PIN LEVELER

VOLTAGE CONTROLLED OSCILLATOR 550-1155 MHz

C601 1000

CW FILTER (DWG 6108-400)

C605 1000

Q602 2N5109

L601

R611 820

C610 27

C620 470

CR601 HPA3001

CR602 HPA3001

L602

L603

C622 .68pf

RF TO S601E (DWG 6108-700)

C621 470

R625 1K

C608 1000

R612 150

R613 150

C606 1000

R605 51

C604 1000

C607 1000

C609 1000

C611 470

R604 220

R606 220

-20V

R607 270

C623 32μf

C613 .001μf

R626 30K

C624 .1μf

R628 1.1K

C625 .047μf

R609 10K

Q603 2N3566

R627 330

R610 7.5K

2N3568 X2

Q605

Q604

R608 39

C616 2700

C612 .004μf

CR603 IN4446

CR604 IN4446

R629 910

-20V

C619 2700

C614 100

C615 100

550-1000 MHz LEVEL DETECTOR (6108-700)

FREQUENCY BAND

550-1000 MHz

S601A

10-550 MHz

0-550 MHz LEVEL DETECTOR (6108-700)

R615 750

C618 470

R618 2K

LEVEL EQUALIZE

R617 2K

R614 1K

R621 360

R619 500 LOWER LEVEL LIMIT

R622 470

R623 15K

R624 5K UPPER LEVEL LIMIT

R620 1K

RF POWER LEVEL

R843 1K

C810 .001μf

R845 560

C807 .001μf

R847 1K

PART OF 6104/8-1

P801

J401

+30V

OUTPUT OF LEVEL REGULATOR AMPLIFIER (DWG 6108-400)

SWEEP TIME VERNIER VOLTAGE (DWG 6108-300)

EXTERNAL

INTERNAL

DETECTOR SIGNAL TO INPUT OF LEVEL REGULATOR AMPLIFIER (DWG 6108-400)

EXTERNAL LEVEL INPUT

LEVEL REFERENCE VOLTAGE TO INPUT OF LEVEL REGULATOR AMPLIFIER (DWG 6108-400)

BLANKING AND LEVEL MODULATION SIGNALS (DWG 6108-400)

-20V

UNLESS OTHERWISE NOTED:
RESISTANCE IN OHMS
CAPACITANCE IN PICOFARADS
INDUCTANCE IN MICROHENRIES
* FACTORY SELECTED VALUE

UNLESS OTHERWISE INDICATED MOST COMPONENTS ON THIS SCHEMATIC ARE LOCATED ON PRINTED CIRCUIT CARD 6108-2. ROUND NUMBERED TERMINALS ARE ON PRINTED CIRCUIT CARD.

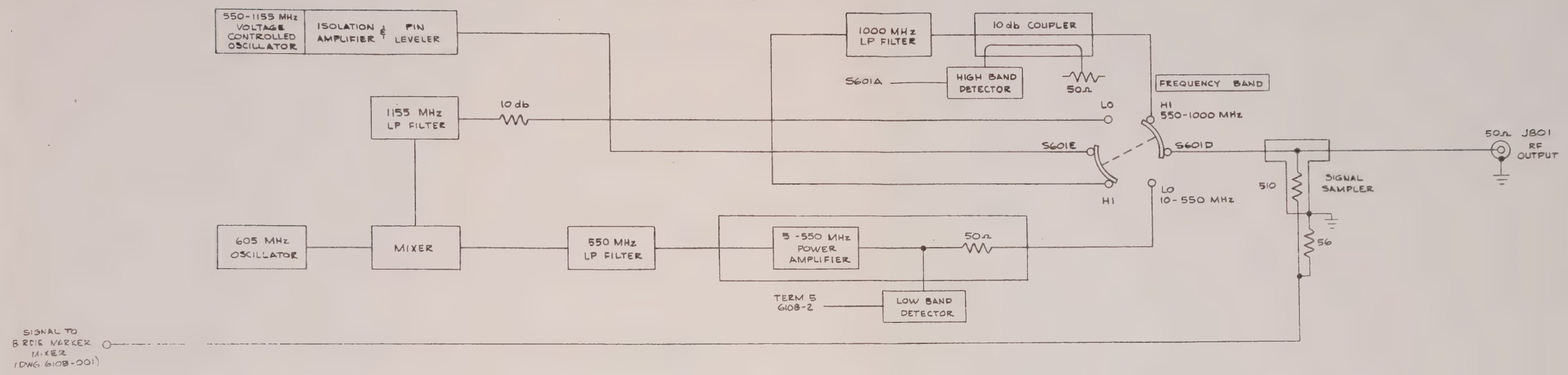
RF GENERATOR AND LEVEL CONTROL

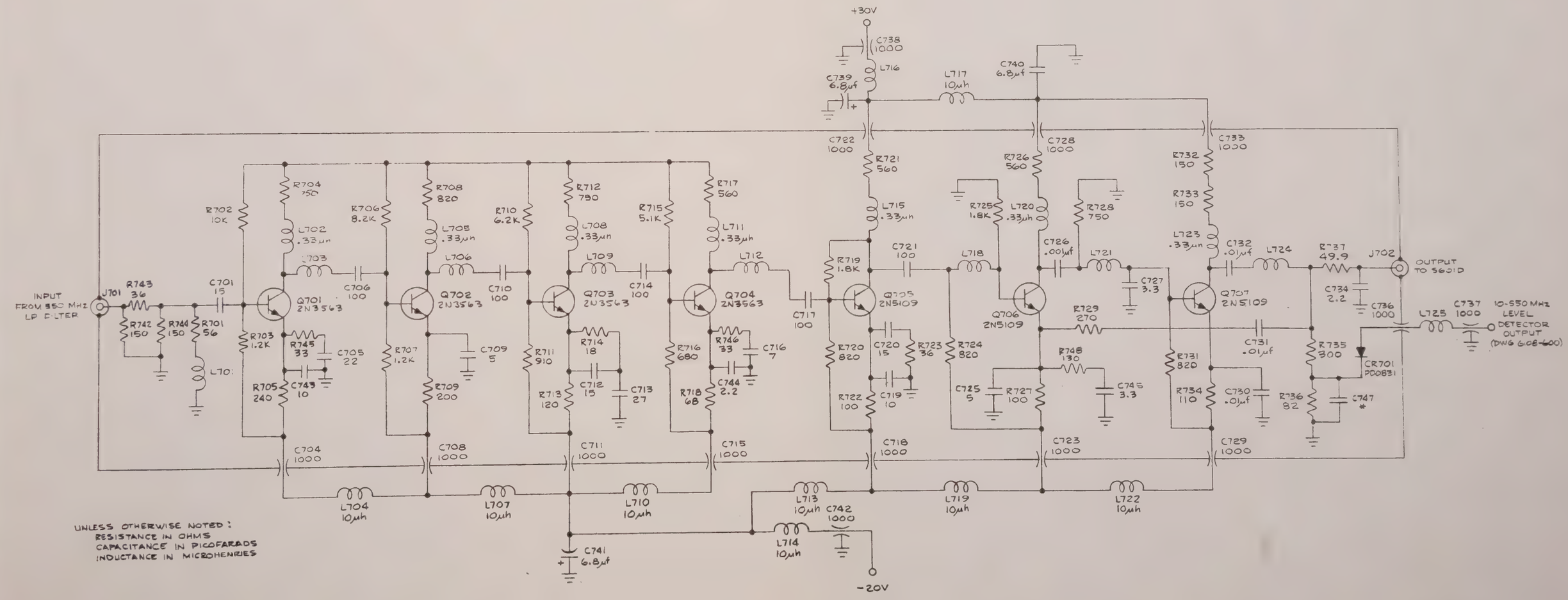
RF GENERATOR AND LEVEL CONTROL

6108-600
9-9-69

PRINT: 9-69

RF SIGNAL DIAGRAM





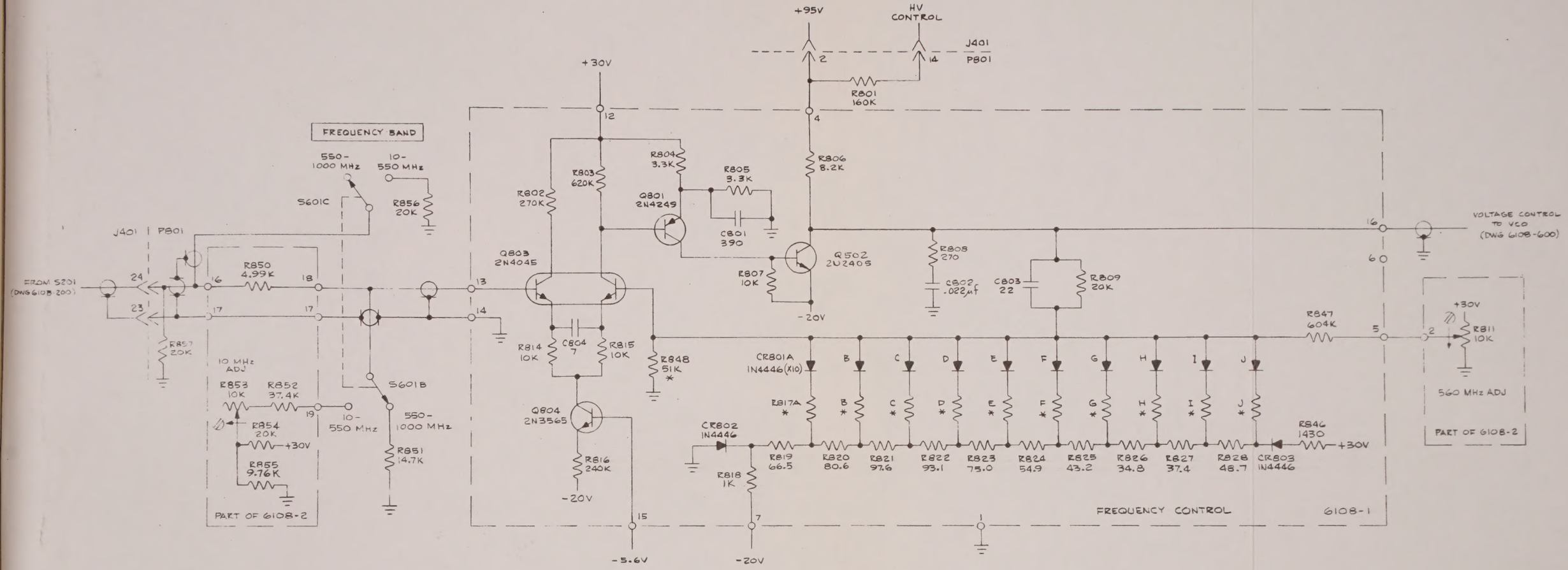
UNLESS OTHERWISE NOTED:
RESISTANCE IN OHMS
CAPACITANCE IN PICOFARADS
INDUCTANCE IN MICROHENRIES

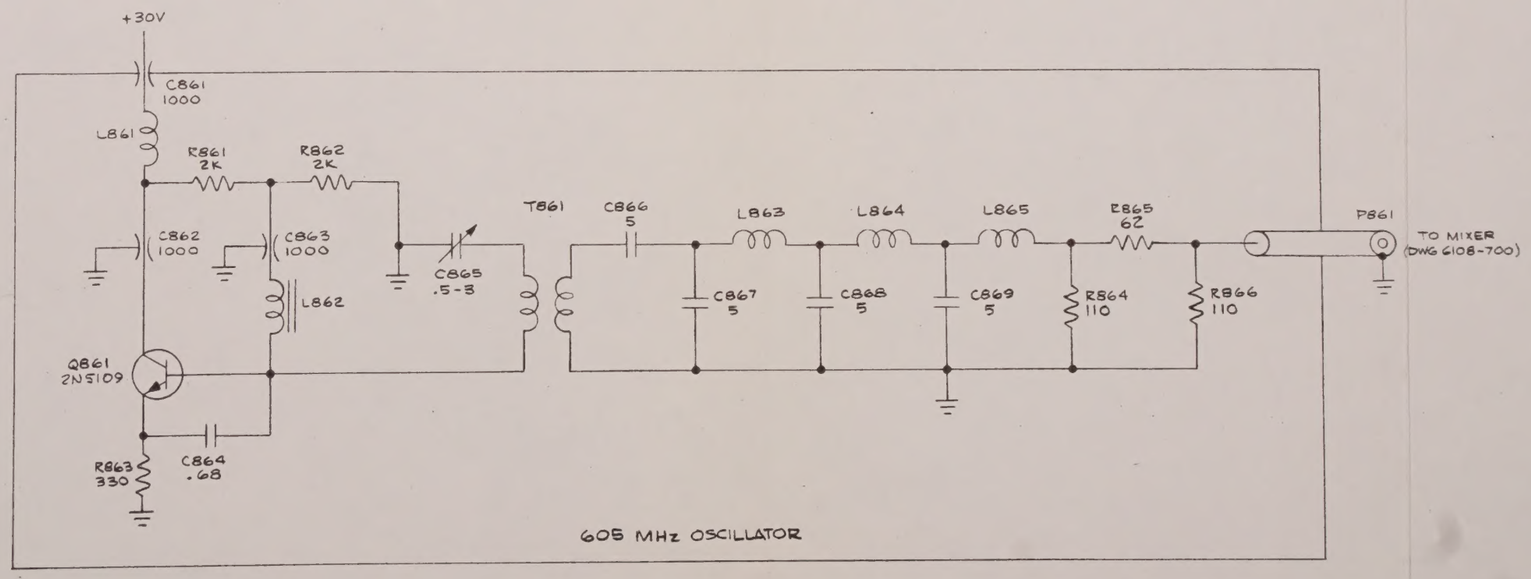
RF SIGNAL DIAGRAM AND POWER AMPLIFIER

RF SIGNAL DIAGRAM AND POWER AMPLIFIER

PRINT: 9-69

6108-700
9-9-69





UNLESS OTHERWISE NOTED
RESISTANCE IN OHMS
CAPACITANCE IN PICOFARADS
* FACTORY SELECTED VALUE

FREQUENCY CONTROL AND 605 MHz OSCILLATOR

FREQUENCY CONTROL AND 605 MHz OSCILLATOR

PRINT: 9-69

6108-800
8-8-69

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